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THE ALUMINUM WORLD: COPPER AND BRASS: THE BRASS FOUNDER AND FINISHER
ELECTRO-PLATERS REVIEW

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Drawing Copper Wire

Reducing Costs in the Copper Wire Drawing Plant of the Habirshaw Wire and Cable Corporation in Yonkers, N. Y.

Written for The Metal Industry by F. A. WESTBROOK, Mechanical Engineer

To increase production and lower unit costs by substituting new machinery and methods for old is not difficult or unusual if the necessary funds are available; but to do this with existing equipment and at insignificant expense is much more of a job and much more interesting. It is a method open to all who know their business thoroughly enough and who bring sufficient intelligence to bear upon it. It is the fundamental first step in "the war on waste."

This is just what has been accomplished at the Bare Wire Plant in Yonkers, N. Y., of the Habirshaw Cable & Wire Corporation. At this plant, of which Mr. J. W. Cooper is superintendent, the production has been increased something over 35 per cent per man. This has not been accomplished by instituting some one or two conspicuous innovations but by a large number of relatively small changes resulting from careful study of all steps in the wire drawing processes. As intimated by the superintendent, these changes are not yet complete and they probably never will be for there is no end to what may be accomplished by continuous careful observation and thought.

In order to get an idea of the kind of changes which brought about these remarkable economies it will be best to go through the plant step by step and see how the processes are now carried on and discuss the improvements as we come to them.

HEAVY WIRE DRAWING

First it must be explained that the building is long and rather narrow in proportion, that it has a saw-tooth roof and that all operations are carried on on the ground floor. This of couse is an advantage to begin with. The raw material, consisting of standard copper rod in coils is received at one end.

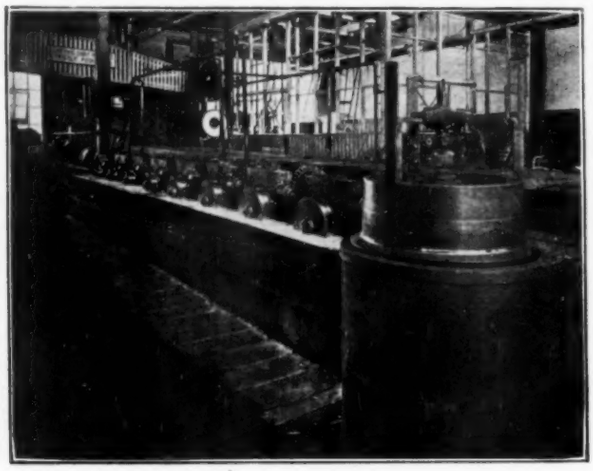
The rod is shipped in from a distance and there is a railroad siding with a raised shipping and receiving platform adjacent to it. When a shipment of rod is received some of it may be unloaded on the platform for early use in the building. The rest is stored in the yard and is generally not unloaded on the platform at all. Later as this supply is drawn on for manufacturing purposes, it is brought up on the receiving platform which has a ramp from the ground at a grade suitable for the ascent of motor trucks.

A narrow wooden chute with high sides has been constructed from the receiving platform leading down to the interior of the mill so that the coils may be rolled to the chute by two men directly from the conveyance which brings them to this point. The coils then roll by gravity down the chute into the building to a point as close as possible to the pickling tanks.

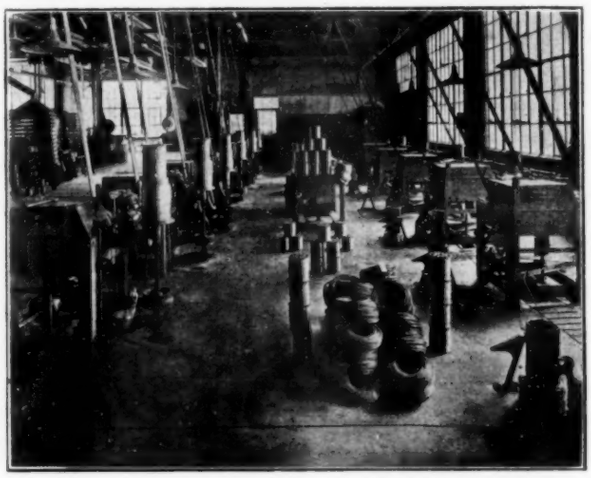
These coils are next handled by one of the men who places them in the chute. To do this he has an air hoist which travels on a monorail and which is provided with a special lifting hook designed by the superintendent. By this means several coils are made into a pile to be taken by an electrical hoist, operating on the same monorail, to the pickling tanks. The monorail passes over the pickling tanks and a washing tank, all in a straight line, and then to the heavy wire drawing machines. All of the latter are reached by the monorail and a number of coils of clean rod are kept in reserve at each of these machines, so that there is never any danger of any of them running out of material. With this arrangement one man can generally take care of the rod from the time it is delivered to the platform end of the chute until it is distributed to the heavy wire drawing machines. Formerly, before the chute and the traveling air and electrical hoists were installed, several more men were needed to do this work,

and it is therefore obvious that the large savings made by the introduction of this comparatively inexpensive equipment, involving no changes in the plant, show a very high return on the investment.

There are four heavy wire drawing machines which reduce the rod to No. 8 A.W.G. wire; each of these is double, that is reduces two rods at a time. Each machine is driven by a 150 hp. motor. Their combined production is 78,000 lbs. per day of 10 hours, with the help of nine men. Formerly fourteen men were required. This is partly due to use of the hoist and monorail for handling the heavy coils of rod at one end and to improvements in the method of winding the wire at the other end on a reel which is easily removed from the center of the coil.



ANOTHER VIEW OF HEAVY WIRE DRAWING MACHINES



FINE WIRE DRAWING

An important factor in reducing the labor costs throughout the plant, it should be observed at once, has been the introduction of a profit sharing system with the workers. This was started in 1926 and, after the usual difficulties accompanying a step of this kind were ironed out, it has worked with marked success. It is a noteworthy fact that nobody was to be seen in the plant who was not busy. Onlookers with their hands in their pockets were conspicuous by their absence.

Before leaving the heavy wire machines it should be stated that a very complete system for filtering and re-using the lubricant has been developed. The cost of this was small and the savings high in comparison. This is just one of those perhaps small items which, nevertheless, when carried out consistently throughout the whole plant, mean so much in the general over-all efficiency.

As the coils of wire are taken off the heavy wire machines they are placed on skips to be taken away by the two electrical trucks. A very practical plan has been put into effect for operating these trucks. Instead of having regular operators for each one, about every man in the plant has been taught how to use them. When a truck is needed the foreman sends one of his men to get it. When not in use the trucks are kept in a regular parking place. The advantages of this scheme are obvious. When handled only by a regular operator the latter is idle a good deal of the time, somebody has to be sent to find him and in the meantime there is sure to be more or less waiting around on the part of others. With the present arrangement no one is idle and enough skips are provided so that coils will not have to be piled on the floor and later handled again if a truck is not immediately available.

Coils of No. 8 A. W. G. wire are taken from the heavy wire machines to one of three places, namely, the tinning department, the shipping department, where they are sent to the Glenwood Plant of the Habirshaw Company for insulating with paper after stranding, or to the intermediate wire drawing machines where they are reduced in size from No. 8 A.W.G. and No. 16 A.W.G. for the manufacture of rubber covered wire and cable in their

ANNEALING FURNACES, WIRE DRAWING PLANT

PICKLING TANKS

Glenwood and Bridgeport plants. Let us follow the coils to these machines. They are located near the ends of the heavy wire machines where the coils of No. 8 wire are removed.

There are five of these intermediate machines, each block being operated by a 20 h.p. motor. They are attended by one man now where it formerly took two to get out the production. The coils of No. 16 ga. wire from these machines may also be taken to the tinning department, the shipping or the fine wire machines.

There are 26 of the latter, four to a 20 h.p. motor and one operator to each group of four machines. A very remarkable improvement has been made with these machines in that they have been speeded up from 500 to 1,500 feet per minute. When asked how this was accomplished the superintendent replied, "Oh, just by playing with them!" While this answer may seem indefinite, and in a way it is, it actually speaks volumes, for every practical man responsible for the successful operation of machinery will appreciate at once that there is no better way of finding out how to get the most out of any machine than by an intelligent "playing with it."

Here again some of the fine wire is tinned, some is shipped without tinning and some of it is put through the fine wire stranders to be used for flexible electrical conductors. High speed stranders are used, each having its individual motor with Link-Belt transmission, which is more satisfactory than belt drive, and push button control placed close to the brake lever. The individual strand may or may not have been previously tinned, depending on the type and size of conductors which they are eventually to be made into. However, they are usually tinned.

Two double tinning units have been provided close to the fine wire stranders to furnish these with material. An interesting detail regarding the method of tinning has been developed. This is that the tanks containing the fluxing liquid has been made both long and deep. The length gives the wire a longer time in the bath as it is drawn through and the depth gives the copper dust, resulting from the drawing, a chance to settle to the bottom and get out of the way.

Of course all wire before shipping or tinning must be annealed. The annealing furnace is an oil burner and it is located at about the mid-length of the building so that wire from any of the machines may be brought to it with the least amount of travel. In fact it is nearest to the heavy and intermediate wire machines which produce the greatest bulk of wires and in the heaviest coils.

The fine sizes of wire are washed after annealing and are then dried in centrifugal laundry extractors. These are equipped with special cylindrical perforated metal baskets with an internal diameter equal to the outside diameter of the coils. This prevents the latter from flying apart when rotated at the high speed of these extractors. After drying, the coils are packed in pasteboard boxes for shipment so as to keep them clean.

The bulk of the wire which is to be used for solid rubber insulated electrical conductors is taken direct from the annealing furnaces to the main tinning room located in an extension on the side of the building back of the annealing furnace. Several improvements of a very practical nature have been put into effect here.

In the first place the coil racks for the untinned wire are near the entrance from the main building. They are raised into place with the help of an electric hoist. The coil rack for the tinned wire is on a raised platform of just the height of the electric truck skips. Thus as the filled reels of tinned wire weighing some 350 pounds are slipped off their spindles they may be rolled directly on to the skips without lifting. The speed at which the reels for a tinned wire are run is also important. If the speed is constant the wire will come through very slowly when operations are first started but will increase as the diameter of the reel increases due to the wire wound on it. In the beginning it is too slow and toward the end too fast. A Reeve transmission has therefore been installed in the motor drive so that the speed of winding the tinned wire may be properly controlled. The shipping platform is near the point where the reels of tinned wire come off.

WIRE TINNING TANKS

While many of the most important details of operation have been enumerated and explained there are many others showing how consistently every possibility of improving the efficiency of the plant has been followed out. For instance, the copper from the pickling solution is regularly reclaimed by the electrolytic process. Furthermore several improvements in the details of various processes are now being worked at and each will doubtless result in some economy. Constant watch is being kept and as soon as some possible improvement suggests itself its development is attacked. Probably this is the most telling manner in which any plant can be kept up to the highest pitch but it must not be overlooked that it takes a very wide awake and broad minded management back of an equally aggressive superintendent to do this.

Metal Exhibits

The International Conference on engineering materials, held in Berlin during October and November, 1927, attracted scientists from all countries. In connection with the conference there was an exposition intended to show how raw materials for the engineering industries may be improved, and accidents, waste and unnecessary expenses due to defects may be avoided. For example, the effects on machine parts, insulators, etc., of fatigue of material were shown. In addition, there were exhibits showing how non-ferrous metals and insulating are produced, and 200 testing machines were shown in operation. Another notable exhibit was a power installation producing energy at 1,000,000 volts.

At the entrance to the exposition there was a copper cup claimed to be the largest in the world. Its diameter was 16 feet, its height 5 feet, and its weight over 3½ tons. A film display showed how non-ferrous metals are pressed, forged, melted and drawn.—A. C. B.

Brass Rolling Mill Progress

A Review of a Quarter of a Century in the Brass Casting Shop and Rolling Mill

Written for The Metal Industry by WILLIAM J. PETTIS, Rolling Mill Editor

THE METAL INDUSTRY with this issue is celebrating its twenty-fifth anniversary. It is interesting to note that this magazine started its life at the time that the great brass industry started making the first radical changes, from the practice established a century ago or more.

The brass mills of the country, or rather of the Naugatuck valley, which was the country, so far as this industry was concerned, while increasing rapidly in size, to meet the growing demand for their product, had made little progress in improved methods, or equipment, except in minor details. The increased demands were being met by duplication of equipment and methods which had been in use in this country since the start of the industry.

CASTING SHOP PRACTICE

The art of casting brass was developed long before the rolling of the metal was introduced, and we will deal first with this department. A study of the illustrations from an article published in 1764 by Gallon, showing a casting shop in operation, and the various tools used, would convince one familiar with the practice that if the ghost of one of these old craftsmen stepped into the casting shop of twenty-five years ago he would have felt perfectly at home, and could pick up his tools, and do his turn, without much instruction. He would, no doubt, be pleased to find his zinc ready at hand, and being relieved of the necessity of preparing the calamine.

It was a highly localized industry, hemmed in by tradition, and dependent on the skill and experience of individual craftsmen, whose knowledge of any particular process was considered his own personal property, the result only going to his employer. And it was a real commercial loss when one of these men "sulked in his tent" or left his job. It was still a far cry to the laboratory and the research department that collects and carefully analyzes the causes and effects of this accumulated knowledge, retaining only the best, and from this evolving an orderly and systematic procedure, with each problem, which enables them to train and make efficient workmen from green material, in a comparatively short time.

The caster's knowledge was largely inherited, handed down through generations of casters, and acquired through the ages by the slow and painful process of trial and error. Among these generations of casters, however, were men who had highly developed power of observation, and naturally analytic minds. These men, each in his turn and generation, added some trick which he found improved his work, or discarded some process, handed down to him, which he found unnecessary or harmful. Through this process the practice had been brought to rock bottom and the fundamental changes were few, but many refinements of practice and some economies were introduced. More efficient fires and an increase in the crucible capacity brought a larger production per man.

EARLY IMPROVEMENTS

The outstanding improvements that began about twenty-five years ago, were an increase in the number of the casting crew, the making up of the charges being supervised by the laboratory staff the "new metal," copper and zinc, and scrap being weighed out in their proper proportions, each melting unit of two hundred pounds placed in an iron box, and delivered to the casting shop, each "turn" using fifty of these units.

The ashes were removed from under the fires by laborers appointed to that work. Previous to that time the copper and spelter were delivered to the casting shop in bulk, the men broke their own spelter, the caster weighing out, and placing a charge in front of each fire, each round calling for about two thousand pounds of metal, and consisting usually of ten pots, five rounds making a day's work. The scrap used in the charge was not weighed. The crew, after punching out their fires at the end of the turn, wheeled out the ashes, in addition to their other work. This put a great strain on the crew, and left the caster little time to give the many details the attention they demanded. On the last rounds many short cuts were taken to the detriment of the work through near exhaustion of the men. It was a step forward when these conditions were changed. The laboratory had begun to function, and greater control of the alloys were exercised. Waste material was looked after more carefully, the amounts of "spills" each crew could have in the ashes was limited, as was, also, the amount of skimmings from the pots. Coal consumption was regulated, zinc losses reduced by more careful handling. In fact all the things which had been accepted as a necessary part of the work began to show the effect of scientific control.

But it was still an unsatisfactory operation, that could not be brought under any exact control. Every pot cast reflected the effect of a large number of variables. The personal element of the caster and crew, and their ability to meet ever-changing factors such as weather conditions, that slow up the fires one day, and speed them up the next. A slow crew on a fast set of fires generally resulted in heavy zinc losses with consequent variations in the alloy to be cast. Fires burned out and let the pot down on the grate bars, often forcing the caster to pour a pot at a lower temperature than was proper, rather than to fall behind in his schedule.

Sets of fires were affected by their location to the stack. A set of fires consisted generally, of ten units, and a stack carried from four to ten sets of fires, depending on the size of the stack. A highly skilled fireman could meet these conditions, and get by. There were not enough such men to go around. Briefly, the procedure consisted of coaling, and lighting the fires, "sticking" and charging the pots; when brought to a proper heat the zinc was added and the pot stirred. This process varied in different shops. In some cases the ten pots were "speltered" before the pouring started. When the first pot was poured it was returned to the fireman who stuck it back in fire number one, put the tongs on pot number two, pulled it and while this was being poured recharged pot number one. This continued until the ten pots were poured and recharged.

This method resulted in a graduated zinc loss; the longer the pot was in the fire, after speltering, the greater the zinc loss. An analysis of pot number one and pot number ten would show an appreciable difference in the zinc content.

Another method which was accepted as the best practice was to spelter only two or three pots at a time. The work called for not only strong men but men who could stand up under terrific heat conditions, and work at top speed. One weak unit in a crew meant confusion, reduced output, and an inferior product. The comparatively high grade of work produced by the brass mills

under these conditions was the result of careful inspection, and ruthless scrapping of all the bad castings turned out.

ELECTRIC MELTING

This was the story of the casting of brass in the rolling mills until the advent of electricity in the melting unit, that gave the control the technical men had demanded, and broadened the field of selection of men for this work, by removing many of the hardships. Its general use in the casting shops dates back less than twelve years, but in that time it has won its place.

MOLDS

The one unchanging thing in the casting shop is the mold. Some external changes have taken place. A better finished and a more easily handled mold has replaced the old type of rough cast iron "backs and fronts" that were assembled by placing together, with iron bands slipped over them and iron wedges driven in between the mold and the band, the number of bands depending on the length of the mold. It reads much more easily than the operation was performed, for the time the mold men had to dress and set up the molds was limited. The improved mold, while it has made the work of "setting up" the molds easier is still an iron box of rectangular shape carrying a maximum unit of one hundred pounds and requiring a lot of nursing to keep it in condition to produce a good casting.

The comparatively small casting delivered to the rolling mill was born, primarily, of the melting unit, entailed by the use of crucibles. A No. 80 pot carried two hundred pounds and was the standard size used in the rolling mill casting shops. The advent of the larger melting unit carrying six hundred pounds to a ton of metal has removed the first problem and with experiments now going forward to force the molten metal through a graphite die, or some other heat resisting, non-friction material, under a graduated cooling process, a casting is possible, limited in weight only by the melting capacity of the furnace.

It is safe to predict that the next important move in the brass mills will be the handling of big units with the consequent saving of scrap and time. This will take place as soon as the casting shops can deliver the castings in larger units. The next quarter of a century should witness many more changes. Perhaps the introduction of a high frequency type of furnace will reduce the melting time to minutes, instead of hours; greatly improved methods and ease of handling, over the present type of furnace, may come with it. A job in the casting shop of the future may be a "white collar" man's job in reality.

THE ROLLING MILL

The rolling mill was not confronted by any highly specialized problems such as the casting shop had to solve. Theirs were largely mechanical. They could draw on many kindred industries for ideas and an army of mechanical geniuses were bringing out new equipment to meet their needs. Manufacturers of machinery for the steel mills were looking for their business and adapting their products to the brass mills, and while they lagged for a while in improving their equipment, they did a thorough job after they got started.

The reason might have been one the writer heard expressed by a steel man some thirty years ago. He was commenting on the necessity the steel mills were under of scrapping equipment, and replacing it with new and improved machinery in order to meet the keen competition in the steel sheet business. He said that the brass mills were making so much money and had so little competition that they did not have to make any changes. However, the last quarter of a century has witnessed a complete replacement of equipment in many mills. Trains of rolls driven by a steam engine have been replaced by individual-motor-driven rolls. Chilled iron finishing rolls were superseded by hardened steel rolls, and the speed of all rolls increased. Automatic blockers have done away with the hand blocking and its dangers. Every operation that was formerly done by man power alone is now handled mechanically.

Annealing has been standardized and controlled by the use of modern fuels, pyrometers and the close watching of the laboratory through chemical analysis and metallographic examination.

While space will not admit of a detailed account of the changes made in all the machines necessary for the production of brass, it is safe to say that there are very few units of equipment or processes that has not been revolutionized in the last twenty-five years. Increases have been affected in the production per roll of sixty to a hundred per cent, and today new types of rolls are being introduced in the industry that promise many improvements and increased speed in the rolling of brass strips.

Manganese Bronze

By WILLIAM J. REARDON

Q.—We are starting to make manganese bronze propellers for small coast boats. Can you give us a good formula for the above metal with tensile strength, etc. of the same?

We would also like to get a formula for making a manganese bronze hardener that we could use in making our own manganese bronze. The wheels we are making must be tough to stand hitting logs and rocks. We will appreciate any information you may be able to send us.

A.—Manganese bronze is produced by first making a hardener of: Norway iron 36 lb.; ferro-manganese, 8 lb.; tin, 20 lb. A furnace capable of attaining a high temperature is required to make this hardener. The iron and ferro-manganese are charged and brought to a red heat; then a small amount of the tin is added. This will help to cut the iron. As the iron melts add the balance of the tin gradually. Stir well. Be sure all is melted and pour into small ingots. Use these ingots as follows:

56 lb. of Copper
41½ lb. of Horse Head Zinc
2½ lb. of Hardener
½ lb. of Aluminum.

Melt the copper first, add the hardener by melting in a separate crucible and pouring into the copper. This method makes the best metal, but it can be done by superheating the copper and then add the ingot hardener. Then add the aluminum and cool the metal a few minutes by adding gates of the same material, or keep out a portion of the copper for cooling purpose. Cool until the metal will nicely melt the zinc and then add the zinc a little at a time.

Stir well and pour into ingots and remelt for casting. For casting, however, you can buy the ingot almost as cheaply as you can make the alloy.

Aluminum Bronze

Progress in the Casting and Working of This Difficult Alloy

Written for The Metal Industry by WILLIAM J. REARDON, Foundry Editor

Aluminum bronze was first made by Dr. Percy, of London, England, and its properties studied by Debray and later put on the market by the Cowles Smelting Company. During the last few years an enormous amount of research work has been carried on to determine the nature and physical properties of this alloy in different proportions. But a long time ago in his treatise on brass foundry alloys, Robert H. Thurston* had this to say of aluminum bronze:

"**Aluminum Bronze.** Aluminum is added to copper and to the bronzes and brasses with good results. The alloy, copper 90, aluminum 10, may be worked cold or hot like wrought iron, but not welded. Its tenacity is sometimes nearly 100,000 lbs. per square inch (7030 kilos per square mm.), and its average is not far from three-fourths as great. It is hard and stiff and very homogeneous. Wire has been given a tenacity exceeding 125,000 lbs. per square inch (8776 kilos per square mm.). Its specific gravity is 7.7. In compression this alloy has been found capable of sustaining a little more than in tension (130,000 lbs. per square inch or 9139 kilos per square mm.), and its ductility and toughness were such that it did not even crack when distorted by this load. It is so ductile and malleable that it can be drawn down under the hammer to the fineness of a cambric needle. Measuring its stiffness, the Messrs. Simms found that it had three times that of gun-bronze and forty-four times that of brass. It works well, casts well, holds a fine surface under the tool and when exposed to the weather. It is, in every respect, considered the best bronze yet known. Its high cost alone prevents its extensive use in the arts."

AMERICAN DEVELOPMENTS

As far back as February, 1896, the South Boston Iron Works, with a piece of Cowles Company alloy obtained as high as 114,514 lbs. tensile strength per square inch.

The National Alloys Company, of Detroit, Mich., has been specializing on aluminum bronze, having taken over the method of manufacture from the Titanium Bronze Company, Inc., of Niagara Falls, N. Y., when they liquidated in 1920.

The National Alloys Company has experimented with aluminum bronze until it now can be made in the form of casting, ingot, wire, or bar without difficulty. Through a special method of pouring they are able to produce a slab for rolling, free from dross. They find titanium a wonderful deoxidizer and with a special flux can produce any shape or weight of casting in sand or permanent mold. The National Alloys Company has been producing worm gears in permanent molds very satisfactorily ever since they incorporated in 1921. The teeth are cast in. One-tenth of one inch is allowed for clean up of the teeth, showing how accurately the teeth are cast. The teeth are made in sections and form around the center of the mold working on a cam. By pushing a lever the teeth are drawn from the casting and the top is lifted out by a device that presses down on the casting and lifts the center with very little effort.

SPECIAL PROPERTIES

There is a demand for a strong gear bronze in order to effect economy. Titanium aluminum bronze possesses high strength and remarkable resistance to alternating stresses caused by shock and vibration, and resistance to abrasion and wear. The burnishing properties of this alloy are very satisfactory, surpassing phosphor bronze. In addition, titanium bronze can be heat-treated and gives 5 per cent increase in tensile strength, 100 per cent in yield point and 50 per cent increase in hardness. Tests show titanium bronze superior to any other alloy for worm gears where extremely high resistance to shock is required.

SPECIAL USES

Titanium aluminum bronze possesses remarkable resistance to corrosion and acids, is non-pitting, non-sparking, has a co-efficient of expansion 50 per cent greater than steel and a strength equal to steel. This material is very desirable for plugs in the oil industry. Due to its expansion it provides a safe tight plug under heat and pressure and on cooling down allows easy removal of the plug.

Despite the general superiority of non-ferrous metals in their resistance to corrosion there is a marked variation in the degree in which the various alloys possess this property.

What is, however, of almost equal importance, is the fact that the behavior of any of the metals varies much or little according to the nature of the conditions to which they are exposed. It is possible to find alloys that will withstand with considerable success comparatively powerful corrosive media, such as fairly concentrated solutions of the mineral acids. Only a few alloys will withstand such attack.

Another use found for titanium aluminum bronze is for welding. It has been found that this material can be made to any degree of hardness and it is replacing copper where large work is done, as the hardness of the metal under heat is such that it will outlive copper five times. It is giving very good satisfaction in welding automobile body work.

Another use is for bearings, for it will give five times the life of phosphor bronze where heavy duty is required with a lot of pressure. The bearings made of this alloy should be reamed and honed, using a burnishing tool to smooth up the hole as irregular spots will not wear down readily and may cut the shaft.

FUTURE POSSIBILITIES

A great deal of information has been published in reference to aluminum bronze regarding its qualifications, but to a great extent such investigations have not been particularly systematic. It is difficult, therefore, at present to provide the complete account for which engineers are legitimately entitled to ask. Nevertheless, the accumulated data are sufficient to make it possible to give the engineers satisfactory indications of many of the properties of titanium aluminum bronze.

The National Alloys Company has also been experimenting on permanent molds for pouring other than aluminum bronze, and the prospect for casting phosphor bronze and other red brass alloys in bearings, collector rings and gear blanks are very encouraging. At some future date, we hope to be able to report on this matter more in detail.

* Robert H. Thurston, A Treatise on Brasses, Bronzes, and Other Alloys, Part 3; New York, John Wiley & Sons, second edition, (1888); Sec. 99, pp. 178-179.

Die-Casting

The Progress in Making Die Castings and the Future Possibilities

Written for The Metal Industry by CHARLES PACK, Vice-President Doehler Die Casting Company

In attempting a review of the progress made during the past twenty-five years in the die-casting industry, the writer can account for only the last 17 years, which covers his actual experience in the industry, since there is very little recorded data on die-casting practice available prior to 1911.

CHARLES PACK
Vice-President, Doehler Die Casting Company

THE ELEMENTS OF DIE-CASTING

The term "die-castings" has been so abused and misused that the writer has always found it advisable to refer to his definition for die-castings (METAL INDUSTRY, November, 1914) in any discussion of the subject. The term die-castings, as used in this paper, refers only to those castings made by forcing molten metal, under pressure, into metallic molds.

Although the principle of making pressure castings in metal molds was in use prior to the last quarter century (see Mergenthaler Linotype machine) the term "die-casting" was practically unknown twenty-five years ago and die-casting as a branch of the metal industry, did not exist. In 1911 there were 4 or 5 companies producing and advertising die-castings on a limited scale. Developments prior to that time were purely along mechanical lines and mainly devoted to the development of a suitable machine for delivering molten metal under pressure and to a suitable metal mold or die for receiving the metal.

It is self-evident that the process of die-casting comprises three basic and essential factors, viz.:

1. Die-casting machine
2. Die or mold
3. Alloy

Prior to 1911 such spasmodic experimentation as was carried on, was devoted to the first two factors only and very little attention was given to the third important factor or to the proper co-ordination of all three factors. Any experiments with alloys were generally carried on by mechanically trained or totally unskilled men on a "hit or miss" basis. Alloys were compounded without any regard to metallurgical principles, the main object being to produce a casting of satisfactory appearance and dimensions. Casting difficulties were generally remedied by the casting foreman, invariably an unskilled man, who, like the quack doctor, had his own panaceas for all casting ills. If the surface finish was unsatisfactory he would add a bar of aluminum; if the castings did not fill out properly he would add some tin, etc. To these conditions must be added the natural sales enthusiasm for a process which made it possible to greatly reduce the costs of manufacture and a total ignorance of the natural limitations of the product, and the early chaotic results can be appreciated.

As a result of the conditions outlined above, the early history of the die-casting industry did not encourage the hope of die-casting becoming a permanent or important factor in the metal industry.

It must be remembered that American manufacturers, twenty-five years ago, had not begun to realize the value of the chemist and metallurgist in industry and only since the world war has the need for thorough and systematic research and technical factory control been fully appreciated. The significance of this fact is more apparent when it is coupled with the fact that today no modern die-casting plant could continue to operate or progress without proper metallurgical control of factory operations. The metallurgist is today recognized as an important factor in every well organized die-casting plant and we must look to the metallurgist for the solution of the problems that confront the die-casting industry today.

DIE-CASTING ALUMINUM

The pre-war status of the die-casting industry was fully described by the writer in a paper on "Modern Die Casting Practice," read before the American Institute of Metals and printed in THE METAL INDUSTRY for November, 1914. Most die-castings used at that time were made from zinc base alloys and a machine had been designed and put in operation for making aluminum die-castings. The process at that time had been applied to only 4 or 5 simple aluminum parts and as stated in the paper mentioned above, the process could not be considered economically sound at that time, until some vital problems had been solved. These problems the writer will discuss briefly.

1. **Machine.** The 1914 aluminum die-casting machine, like all experimental machines, was naturally rather crude and due to the higher casting temperatures involved and the great affinity of molten aluminum for the iron parts of the machine immersed in the metal, the maintenance cost of operating this machine was excessively high. Subsequent development work was devoted to reducing this factor of cost. Although the problem has not been solved entirely and at this date no material has been found for the construction of machine parts that is absolutely insoluble in molten aluminum, nevertheless, by co-ordination of machine design with new materials of construction, this problem is now of minor importance and need not be considered as a serious factor in casting costs.

2. **Design of Dies.** In constructing the first dies for aluminum the designer was of necessity governed by his experience with dies for zinc. It was soon found that the higher melting point and greater shrinkage of the aluminum alloys necessitated the construction of dies competent to withstand the more aggravated conditions. This problem has been solved by consistent study of service conditions and the application of the knowledge gained, to subsequent designs on new dies.

3. **Die Steel.** The melting points of the alloys commonly used prior to 1914 did not exceed 800° F. For dies used with such alloys, any good grade of steel, if reasonably free from visible defects, was found satisfactory. With the development of a machine for die-casting aluminum, and with the first production with this machine, it was soon found that the steel used in zinc alloy die-casting practice would not meet the requirements for aluminum alloy practice. Dies constructed from steel

used in zinc practice were found to surface check and become unusable after 1,000 castings had been made. This presented the most serious problems in the development of the aluminum die-casting process. Unless a die-steel could be developed that would stand up under the severe service conditions, it was evident that the die-

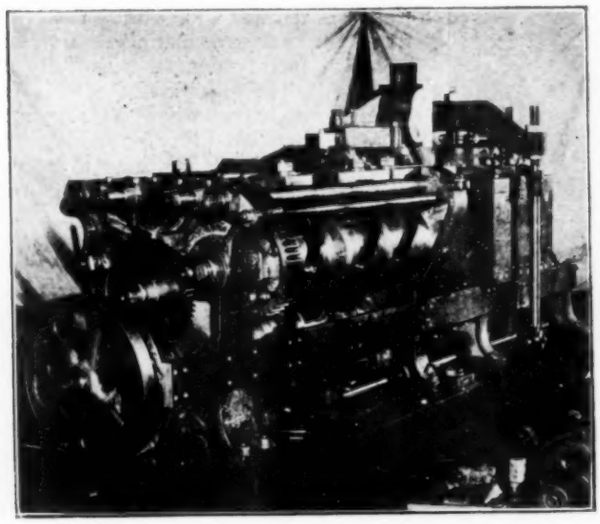


FIG. 1. MODERN DIE CASTING MACHINE

casting of aluminum could not be considered a commercial process.

Since 1915 this problem of aluminum die-steel has had the attention of many experimenters throughout the world. Today aluminum die-castings are being made in dies that stand up for from 50,000 to 150,000 castings but the problem is not entirely solved since such dies require very close and accurate control of mill and heat treating practice with the constant possibility of dies breaking down in service prematurely. In the modern die-casting plants, the major portion of metallurgical talent available is devoted to the testing and control of aluminum die steels, their heat treatment and to the development of better die steels and heat treating methods.

It will be noted from the foregoing that the first successful experiments with aluminum die-castings were carried on after the outbreak of the world war but prior to our active participation in the war. The research and development work on aluminum die-castings during this period of our neutrality proved to be of valuable service when this country decided to join the Allies in active combat against the Central Powers.

Immediately following our declaration of war it was decided to send the first expeditionary force of 30,000 men to France as soon as possible. In equipping these men it was necessary to produce 30,000 gas masks within one month. The main difficulty in carrying out this program lay in the problem of producing the breather tubes for the masks. These parts were re-designed for aluminum die-castings, a die constructed and the first 30,000 masks were produced within the specified time. The development of the aluminum die-casting process during the two prior years made this achievement possible. Millions of these gas mask parts were made during the war and at the close of the war one company alone was making 50,000 parts per day. All types of masks developed since the war, including all masks now adopted by all branches of our military and naval forces, comprise the use of one or more aluminum die-castings.

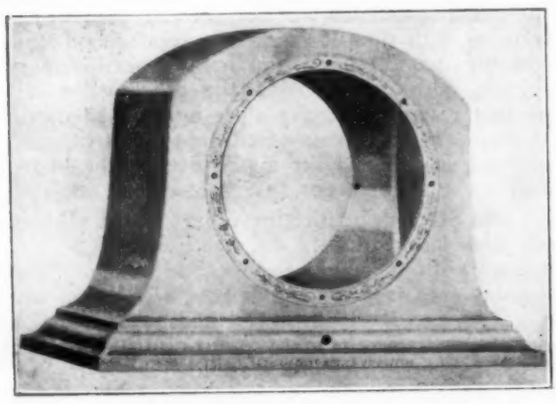


FIG. 2. RADIO LOUD SPEAKER HOUSING

Progress in the die-casting industry, as in all other industries, was naturally retarded during the war since all die-casting facilities were devoted to the manufacture of war materials. Die-castings were used during the war by all branches of the service. Foremost among such uses may be mentioned the hand and rifle grenade "bouchons" on which a production of 500,000 daily was reached before the armistice was signed. Die-castings were also used in Lewis machine guns, Browning machine guns, signal pistols, automotive equipment, surgical instruments, binoculars, trench mortar shells, torpedo fuses, and in many other instruments of warfare too numerous to mention here.

PROGRESS SINCE 1919

Since the close of the war extensive progress has been made in the die-casting art. The writer will attempt to outline briefly the most important of these developments.

1. Machines. If the reader will refer to the 1914 paper mentioned above he will find an illustration of a die-casting machine that was considered highly efficient at that time. Pressure was applied by manual force directed at the end of a long lever. Fifty to one hundred operations per hour were considered good production. In Fig. No. 1 is shown a modern die-casting machine. By the movement of a lever the die is closed, metal is forced into the die, cores are pulled, casting is ejected, cores are replaced, and the die is ready for another operation. In making the most complicated casting,

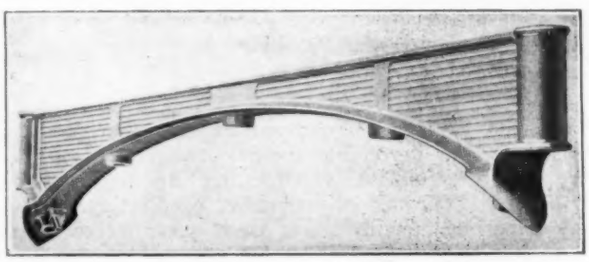


FIG. 3. COWL BAR, 48 INCHES LONG

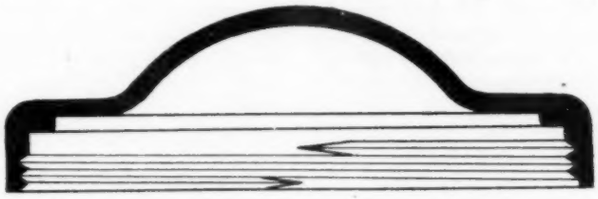


FIG. 4. PHONOGRAPH SOUND BOX

no manual labor is required beyond the movements of one lever. The speed of the machine can be regulated at will and is only limited by the rapidity with which the metal will solidify, which in turn is governed by the bulk

of the casting and the extent to which artificial cooling means can be applied to the die.

2. Large Castings. The die casting process was first applied to comparatively small castings. Extensive progress is being made in developing machines competent to produce larger castings. As an illustration of the modern die casting art, Figure 2 shows a radio loud speaker housing, 15 in. long 10½ in. high and 7½ in. deep. As produced, these casting require only a light sand blasting operation before lacquering. The entire outside surface must be free from any surface imperfections. Under these rigid specifications 300,000 castings have been produced by one company. Figure 3 shows a Cowl Bar 48 in. long. Such cowl bars are used by a number of automobile manufacturers including some of the highest quality cars produced in this country.

3. Thread Casting. In Figure 4 is shown a phonograph sound box with internal thread cast. Over a million of these castings have been made in a multiple die with a daily production of 8,000 to 10,000. Figure 5 shows an ornamental casting where two concentric threads are cast automatically. The foregoing are only two out of hundreds of similar illustrations of modern die-casting practice available.

4. Alloys. It would be difficult to discuss this vast subject in the limited scope of this paper. Progress in die-casting alloys has kept pace with all other metallurgical developments. Die-casting alloys have passed cast iron in physical properties and today compare more favorably with the brasses and malleable iron. The natural limitations of some die-casting alloys from the standpoint of corrosion have been greatly mimized by developments in the art of electroplating, particularly with the metals cadmium and chromium.

Die castings are now used under severe pressure conditions where liquid or gas pressures may exceed 200 lbs. per square inch.

FUTURE DEVELOPMENTS

As noted above, future developments in the die-casting industry will depend mainly on the results of metallurgical research in this field. The development of strong and corrosion resistant alloys suitable for die-casting is the aim of all experimenters.

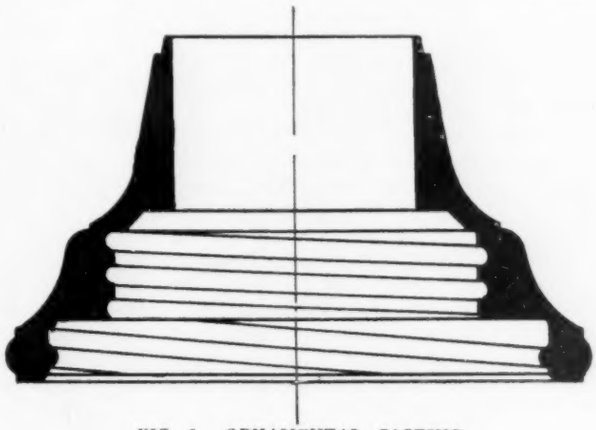


FIG. 5. ORNAMENTAL CASTING

The development of new and better die materials is still the most vital problem facing the die-casting industry. The progress made in the solution of this problem will govern the progress that will be made in the process of die-casting the metals of higher fusing points which is the ultimate goal of the die-casting process.

Nickel on Zinc Alloys

Q.—I have been plating hub caps and radiator caps made of zinc for some time. When we first make up our solution it works fairly well, but later gets quite alkaline, and the work streaks up with black and does not give a clear surface when buffed. Sometimes we can overcome this by copper striking them, but about a week later small blisters appear all over the surface, which could not be detected immediately after the part was plated. These blisters only appear on those that were copper struck. We also have trouble quite often with peeling. Our solutions are as follows:

Cleaner:

Water	1 gallon
Soda ash	1 8/10 ozs.
Sodium cyanide	1 3/10 ozs.
Caustic soda	5/10 ozs.

Nickel:

Water	1 gallon
Single nickel salts	12 ozs.
Boracic acid	2 ozs.
Ammonium chloride	1 oz.
Glauber's salt	12 ozs.

A.—Copper plating of zinc is an undesirable feature as you have experienced. To remove any zinc that has accumulated in your bath, neutralize the solution with nickel carbonate. Very carefully remove only the clear solution and throw sediment and bottom 4 inches of solution away. Clean your tank out thoroughly. Return the clear solution, and make up to complete volume with your own formula. In addition add 2 ozs. boric acid per gallon and 4 ozs. sodium citrate. The sodium citrate will do two things: Retard nickel deposition by simple immersion, and aid in keeping your acidity up. However, do not neglect to add periodically, boric acid, and also sodium citrate. The amount would be entirely dependent upon the volume of work you put through. With no chemical means of determining acidity, you would not go wrong by adding ⅛ oz. boric acid per gallon once a month. A more valuable method of plating zinc is to first use a striking bath of the following composition.

Single nickel sulphate	12 ozs.
Double nickel sulphate	6 ozs.
Sodium citrate	4 ozs.

Strike at a C. D. of 50 amperes per sq. ft. for 1 minute, then transfer to regular nickel bath.—JOSEPH HAAS.

Depositing Beryllium

"Beryllium, a metal one-third lighter than aluminum, and one-fourth more elastic than steel, may soon come into general use through a new method of electro-deposition," says the New York State Committee on Public Utility Information.

Beryllium has been known for more than a century, but the cost of its extraction has hitherto made it too expensive for commercial use. By the electrolytic method it can be made available for airship frames, motor pistons and various other purposes where strength, lightness and elasticity are essential.

Beryllium is chemically related to aluminum, and its ores are found abundantly in this country, particularly in feldspar mines, where they have been considered as waste. Beryl, the semi-precious stone, is a common form of beryllium ore.

The Reclamation of Defective Brass Castings

The Use of the Oxy-Acetylene Torch for Repair Work in the Foundry

Written for The Metal Industry by PETER W. BLAIR, Mechanical Editor

The cost of repairing a large proportion of castings is so relatively small with the use of the oxy-acetylene torch that this factor in foundry production needs little emphasis in the present day.

Another field of considerable utility which has been overlooked is the reclamation of defective brass castings. Of course conditions vary widely from plant to plant so general statements are difficult to make. However one should not conclude that a small casting, if slightly defective, could be re-made for less money than it would cost to repair it by ox-welding. Too many times a person thoughtlessly says that a casting is worth only a few cents, so scrap it, without realizing that the old one must be cleaned before remelting and some of the metal is lost in the furnace. Remelting picks up impurities and lowers the quality of the output. A new mould must be made, poured and shaken out. All this must be done and paid for on all defective castings which are remelted. About the only thing saved is a part of the metal valve which may be relatively small. When it is remembered that the ordinary defect is quite minor, a blowhole, a shrinkage crack or part of a lug missing, it will be realized that the cost of repairing by ox-welding will be very small indeed. As a definite instance may be cited an eastern foundry manufacturing such things as brass steam valves, faucets, bath-room fixtures and unions and fittings for brass pipe; all small pieces.

General foundry conditions were good, as proved by a figure of 95 per cent perfect castings made. Even so, the use of ox-welding for reclamation has increased so that it is now rarely necessary to remelt a casting. Reference to their cost sheets shows that one month 3,801 brass and bronze castings were reclaimed by ox-welding at a total cost (including overhead) of $572.02, and at a saving of $1,099.86 over the cost of replacing. In another month $2,156 worth of castings were reclaimed at a total cost of $355, a saving of $1,801. Remember too that each of these pieces had to pass a hydraulic test for strength and tightness before acceptance and that most of them were to be nickel plated, both requirements demanding the utmost care by the welder to produce sound metal.

It was stressed, however, that an intelligent use of the oxy-acetylene process was no reason for letting down the barrier of quality, simply because any casting could be patched up. It is obvious that sound management will insist on best moulding and casting practices to keep the number of castings needing repair to the minimum. Cheap though it may be to repair a slight sand hole, even that expense is unnecessary with perfect castings.

Another branch of the foundry industry which has the disposition of defectives and wasters as a major problem is the aluminum alloy casting business. Because of the nature of the metals and alloys involved it is more difficult to make a high percentage of the castings to pass inspection. There are three methods of reclamation: (1) burning on; (2) soldering; (3) oxy-acetylene welding.

Burning on consists of placing the casting on the mould and adding metal to fill out the defective section. This is an uneconomical process because of the difficulty experienced in securing a bond between the parent and added metal. Soldering is rejected by all careful inspectors except for the mere purpose of filling in to save appearances, since the soldered joints fail in strength. It is therefore conceded that oxy-acetylene welding is the only feasible method of reclaiming defective aluminum castings. Good welding practices must be followed or the weld will be of such coarse grain as to be appreciably weaker than the casting but a properly made weld will have plenty of strength when it is considered that the factor of safety in such castings is usually placed very high. It requires no argument to show that a large and complex casting should be ox-welded rather than discarded for a small defect.

As an illustration, witness the large automobile plants where they weld crank cases, motor heads, transmission covers and pistons. This is a regular production schedule. In order to make a machinable close-grained weld, certain definite precautions must be taken. In the first place correct welding rod must be used. The weld must cool slowly and in the majority of cases must be preheated.

Belt Grinding

By W. L. ABATE

Q.—Preparatory to the polishing of the brass bodies of the faucets and other fixtures we perform the coarse grinding and fine grinding on felt wheels set up with emery. Are abrasive belts better suited to that class of grinding and do they provide a larger output per man? Any comparison that you are willing to give us on the two methods of grinding will be appreciated.

A.—The use of abrasive polishing belts on bibbs and like pieces of brass which have a female circular form and which parts cannot be readily reached with a wheel is advised and recommended. The under part of a bibb and the rear part of the nose can be done more easily with a belt than with a wheel and also more uniformly. The belt is more flexible and fits the contour of the casting better.

A number of different belts would be necessary, at least 50 for each man and these would be set up in different grades of abrasive and of different widths to fit easily into the contour of the casting. They should never be crowded into a crevice.

While we advocate belts for the inner surfaces we do not claim that they are as good as wheels for the exterior parts. Wheels, made of soft pliable canvas, properly set up, of say about 12 in. diameter, running perfectly true, will hold the abrasive better than felt and will cut faster. We would advise you to experiment along this line feeling sure that you will be well repaid for your effort. The finishing abrasive should be fine, in some cases No. 180 being used for a quick run over, which saves a lot of time and material when buffing.

Should you adopt belts for your difficult parts, we would suggest that the machine carrying the belts be such that the belts can be easily removed and that the operator work on the vertical part of the belt. Some work is done on horizontal belts but not small brass parts.

Electric Smelting Advancement

Recent Developments in the Induction Furnace and the Progress It Has Brought About in the Melting of Metals—Part 1

Written for The Metal Industry by G. H. CLAMER, President, The Ajax Metal Company

It is my purpose in this paper to deal mainly with the advances in the art of metal melting due to the introduction of the vertical or submerged ring type of induction furnace, and to refer at the same time to the more recent development of the coreless induction type of furnace. I shall endeavor to avoid, so far as possible, technical descriptions such as may be understandable only by the electrical engineer. This paper is written for the brass melter.

At the outset, for clarity sake, it will perhaps be desirable to briefly describe what an induction furnace is.

G. H. CLAMER
President, The Ajax Metal Company

The induction furnace is one in which the electrical energy is converted directly into thermal energy in the metal to be heated, due to its resistance to current flow. Such a furnace is in reality a current transformer.

When an electric current flows through a conductor, magnetic lines of force are formed around the conductor in concentric rings. If the current is discontinued, this field dies down similar to a rubber band that is stretched into a large circle and then released. These lines of force, in dying down, cut the conductor. Whenever lines of force cut a conductor, a voltage is induced, and if the secondary electric circuit is so placed that the lines of force from the first conductor will cut it, then a voltage will be induced in it. With an alternating current, the value of the current, and, hence the number of lines of force, is continually changing from zero to a maximum and then back to zero. The rate of this change is called the frequency. In order to increase the number of lines of force and have them take a certain path in order that as many as possible of the lines will cut all of the conductors, iron is used to inter-link the conductors. Air is a poor magnetic conductor; iron is many times better. The induced voltage is proportional to the number of cuts in unit time. For example, if we have 1,000 lines of force cutting 10 conductors in one second, a certain voltage will be induced. Now if we double the lines of force or double the number of conductors or cut the time in half, the voltage will be double. We may now express these three conditions in a formula:

$$(1) \qquad V = C \times F \times T \times L$$

V = the voltage, C = a constant, F = the frequency
T = the turns, L = lines of force.

The combination of two coils and an iron core interlinking them constitute what is called a core transformer. By means of a core transformer any voltage desired may be obtained, either higher or lower than the supply voltage. Formula (1) applies to both coils of a transformer, the primary coil being the one connected to the supply; the secondary coil the one with the changed voltage.

As the constant C, the frequency F, and the number of lines L are the same for both coils, then it follows that the voltage is proportional to the number of turns. This may be expressed in a different way, as follows: "The voltage per turn is a constant."

For example, if the primary voltage of a transformer is 220 and the primary coil has 22 turns, the voltage per turn is 10. Now, if the secondary coil has 5 turns, its voltage will be 5×10, or 50. If the turns of the secondary be changed to 10 turns, its voltage will be 100. The efficiency of a transformer will average about 97 per cent, therefore, for simplicity, we may say that the input equals the output. Let P_1 equal the primary power, P_2 equal the secondary force, E_1 equal the primary volts, E_2 the secondary volts, C_1 the primary current, C_2 the secondary current. T_1 the primary turns, T_2 the secondary turns. Then

$$P_1 = E_1 \times C_1 \qquad P_2 = E_2 \times C_2$$
$$P_1 = P_2 \qquad E_1 \times C_1 = E_2 \times C_2$$
$$\frac{C_1}{C_2} = \frac{E_2}{E_1} = \frac{T_2}{T_1}$$

The current is inversely proportional to the voltage and inversely proportional to the number of turns.

The foregoing rules are of great importance in the design of transformers and also of induction furnaces, for an induction furnace is simply a short-circuited transformer under control. It is an ordinary transformer in which the secondary is formed by molten metal.

There are two kinds of induction furnaces, namely, iron core type and coreless type.

The iron core type is further divided as follows:

(1) Furnaces having an open molten secondary in a horizontal plane.

(2) Furnaces having a closed molten secondary in any position from horizontal to vertical, and having the same submerged beneath a bath of molten metal.

The coreless type of furnace has a hearth or crucible which may vary in shape from that of the ordinary crucible to that of a shallow or saucer like pool. It has no submerged resistors and no interlinkage of iron.

HISTORY OF DEVELOPMENT OF INDUCTION FURNACE

Twenty-five years ago when THE METAL INDUSTRY, the publication in which this paper appears, was founded, the electric induction principle was known and it was just beginning to be applied for steel melting. In fact, fourteen years prior to that time, namely, in 1888, E. A. Colby of the Baker Platinum Company of Newark, N. J., invented and patented the basic idea upon which was founded the induction furnace art. DeFerranti in England patented a similar induction furnace at approximately the same time as Colby.

The furnace of Colby was of the simple horizontal ring type in which the secondary consisted of a single turn of molten metal interlinking a magnetic circuit. In the Colby type of furnace, the primary coil was placed out-

side of the secondary circuit. Colby did not succeed commercially in accomplishing that which he set out to do, viz.: melt platinum, but he did give to the world a type of electric furnace which for many other purposes has been developed into one of great usefulness and importance.

DeFerranti also placed his primary coil outside of the secondary circuit. The magnetic leakage was therefore very great, and the power factor consequently low. Both Colby and DeFerranti were no doubt afraid to place the primary coil within the molten secondary because they had not developed a proper means for protecting the primary coil from the heat radiated from the molten secondary.

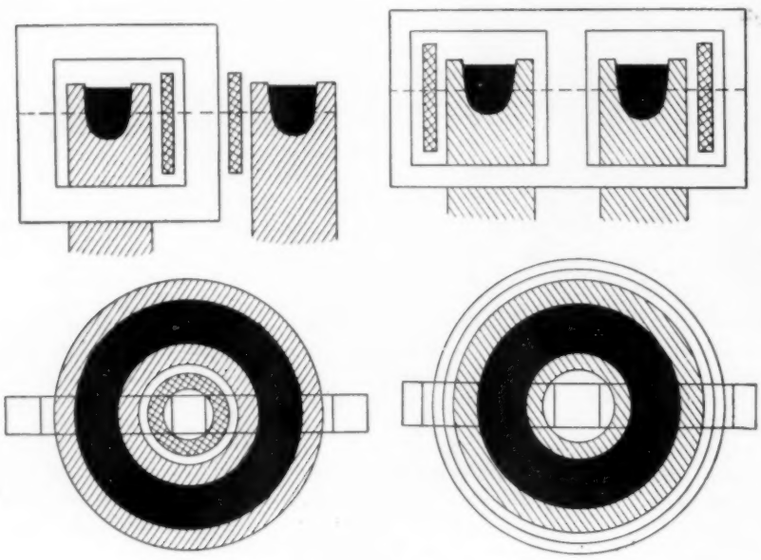


PLATE 1. INVENTION OF KJELLIN PLATE 2. INVENTION OF COLBY

Kjellin a few years later patented a furnace in which the primary coil was placed inside of the secondary. Magnetic leakage was thereby greatly reduced and the power factor greatly increased. The Kjellin furnace was only partially successful for a short period as a commercial steel melting furnace.

A vast amount of money has been spent on the horizontal ring type furnace in the hope of developing a satisfactory steel melting equipment. Only a few of the furnaces installed are still operating. This type of furnace has a number of disadvantages chief among which is the shape of the hearth. The hearth has small holding capacity in comparison with the surface exposure both to the atmosphere and to the refractories. This leads to heavy heat losses. It is inconvenient for charging and refining. Such operations cannot be satisfactorily carried out in them. The larger the capacity of the furnace, the greater must be the diameter of the secondary ring. The enlarging of the secondary ring occasions a looser coupling with the primary coil, hence greater magnetic leakage and a lower power factor. In order to overcome this, such furnaces have been supplied with power at a frequency below normal. To supply a frequency below normal means a converter set, and these for such low frequency are very large in size and costly.

The chief reason, however, for the failure of the horizontal ring furnace has perhaps been the difficulty with the refractories. Namely, the difficulty in maintaining a metal tight channel or hearth.

A few attempts have been made to melt the copper alloys in the horizontal ring type induction furnace. These attempts early led to failure because of the manifestation of the now generally known "pinch phenomenon." Namely, the breaking of the molten secondary circuit which results due to the mutual attraction of the current elements.

Pinch phenomenon manifests itself if the current density becomes too great. If current density becomes greater than is possible for the molten secondary to carry, the secondary is disrupted and the electrical circuit broken. Momentarily while the circuit is broken, no current flows. The addition of heat thus ceases, and the metal in the furnace solidifies.

The American Brass Company experimented quite early with an open ring furnace. Their experience with melting brass in a furnace that had been designed for steel melting was that the circuit was disrupted with violence almost immediately, due to the combined effects of pinch phenomenon and zinc volatilization at the point of rupture.

Prior to the referred to experiments of the American Brass Company, Charles P. Schneider, President of the Creusot Steel Works of France, designed the original submerged channel induction furnace in which there was a pool of metal that exerted a hydraulic pressure upon the molten metal in closed channels or channels constituting the secondary loop.

The Schneider furnace was tried experimentally both on brass and steel. It was not successful because the circulation was so sluggish that overheating resulted in the resistor channels. When brass was melted, the temperature soon rose to such degree that the zinc was volatilized with violence and in melting steel the temperature of the steel in the resistor channels became so great that melting of the refractories resulted.

The next step in advancing the art was contributed by Carl Hering. In 1911 Hering invented a furnace in which he made use of the pinch phenomenon, discovered by him about two years prior. In his furnace he used pinch pressure for producing circulation within resistors in which the heat was generated. This pressure also stirred the pool with which the resistors were connected. Although Hering, in all the furnaces built by him used electrodes, the principle of operation in accordance with his patents was nevertheless applicable also to induction furnaces as disclosed in the process claims of his patent. This interpretation has recently been placed upon the patents by a German court.

A practical way of applying the Hering pinch effect principle in an induction furnace was the invention of Charles B. Foley. Foley conceived the idea of constructing the resistor (secondary) channel of an induction furnace at a point farthest from the bath. Foley was the first to conceive the idea that circulation should proceed from the bottom upward, or from a point farthest from the pool. Claim No. 17 of the Foley patent, as follows, broadly covers this principle of operation:

"The method of heating and stirring the pool of molten metal in an electric induction furnace, which comprises forming by suitable refractory walls a pool of molten metal and a loop of molten metal connection with the bottom of the pool, heating the metal by induced electric currents and simultaneously driving the hot metal from the loop by the application of electromagnetic pressure acting with maximum intensity on the metal in the outer or lower part of the loop."

The Ajax Metal Company purchased Charles B. Foley, Inc., the holders of this patent. The Foley patent, although filed in advance of the Wyatt patent under which the Ajax-Wyatt furnace is manufactured and sold, was only recently issued.

This article will be continued in an early issue.—Ed.

Changes in Brass Finishing

How the Present Brass Machine Shop Differs From the Shop of the "Good Old Days"

Written for The Metal Industry by W. L. ABATE, Brass Finishing Editor

Brass finishing of today is very different from what it was fifty years ago. It is about as easy to find a real brass finishing shop as it is to find a real blacksmith. Both of these arts have undergone so many changes that they are a different story to the present generation. The Fox lathe is scarcely found at all in the present brass shops whereas in other days it was practically the only machine for production work. All duplicate parts of articles made of brass, particularly if they were threaded, were sent to the Fox lathes. Fifty years ago there were no emery wheels and none of the grinding machines for grinding hardened tools such as we have today. We had no twist drills. All drills were forged flat from round steel, and every brass finisher had a stock of flat drills in his tool box. Emery wheels and twist drills were just making their appearance, but were not in general use, the cost being considered prohibitive.

By the way a tool box was a box in those days. It was a whole machine shop.

Speaking of flat drills it is not generally known that they will cut a cleaner hole if properly made than a twist drill. Where pet cocks were made it was the custom to drill the plug and body after the cock was ground. Flat drills do not injure the ground surface at the juncture of the plug and body. In those days the milling machine had not come into its own in the brass shop. The turret lathe was just coming into use and with the advent of this tool all the previous practice of the brass finisher began to change. He lost his job on the Fox lathe and speed lathe, for all parts were speedily redesigned so that they might be finished on the monitor lathe.

Thus began the production era for the brass industry. Perhaps the greatest users of the Fox lathes today are the railway brass shops, although they also are making a good deal of duplicate brass work on turret lathes. The old time brass finisher was required to turn all exterior parts with hand tools and slide rest. Today all this work is done with forming tools in the turret lathes. In the olden days we were taught to turn by hand and chase our threads by hand. Should we get an order for 500 pet cocks we would be required to take the rough castings and finish the job complete. We used to make end forming tools out of old files because we had to keep them hidden away from the foreman. We were not supposed to use forming tools as they were held in disgrace as killing the industry. We could always find old files where it was not always possible to get steel from the boss.

There were no time cards kept on the job, but the foreman knew who were the best and speediest men and they were paid accordingly. Average men earned the large sum of $10.50 per week of 60 hours. The good man got $13.50 for the same period and the very good man, $15.00 per week. I never knew a man to earn $20.00 per week in any of the shops in which I worked. As a matter of fact even with all their experience they were not worth any more for their production was so small that even with the higher prices for which the goods were sold then, there was not much left for the boss. However, the same condition prevails today. The present equipment of the modern brass shop including foundry, machine, pattern and tool shops requires that it be kept in constant operation at full speed to make it pay reasonable return on the investment and unfortunately that requires a multiplicity of orders that have to be fought for in the open market. The upkeep of all the modern machinery is very expensive and the delays of repairs are very injurious to profits. The brass shop that has an experienced brass man at its head of operation is better fitted for success even though its equipment may not be strictly up-to-date, and I regret that the art is not being taught as it once was in this country by a four-year apprenticeship.

Nickel Solution Additions

Q.—I have found the Metal Industry very helpful in the past and would be glad if you would kindly give me a little information. What is the object of adding chromic acid to nickel solutions and how much? Would sodium fluoride take the place of acid fluoride?

A.—No useful object could be obtained in adding chromic acid to a nickel solution. It would ruin it for good nickel plating. If the use of hydrofluoric acid is to maintain the proper acidity, then sodium fluoride cannot be used in its place. But if the use of fluorides is to keep the solution clear of suspended sludge, then sodium fluoride with boric acid is much more desirable.—JOSEPH HAAS.

Mechanical Brass Solution

Q.—Will you kindly send me the latest and best mechanical bright brass solution.

A.—

Water	1 gallon
Sodium cyanide	10 ozs.
Copper cyanide	6 ozs.
Zinc cyanide	2 ozs.
Rochelle salts	4 ozs.

For a brightener, use nickel carbonate dissolved in sodium cyanide. Use only as needed, as too much will affect the shade of brass.—JOSEPH HAAS.

Tin Solution

Q.—Would you be so kind as to tell me what is a good tin solution? I want to tin plate some little pieces that have a ¼" hole in them, and the plate is to go right through the hole. I would like an acid proof plate. Does tin plate dip off in an acid dip composed of sulphuric and nitric acid? I have one composed of sulphate of aluminum and chloride of tin. Would that be acid proof on account of the aluminum in it?

A.—Use the following solution:

Stannous chloride	2 ozs.
Sodium pyrophosphate	8 ozs.
Dextrin	1 oz.

Use the solution at 140° F-160° F. with a current density of 3-5 amperes per sq. ft.

How well the tin resists the action of acids will depend upon the amount of plate and the acid it is to withstand. A heavy tin plate will withstand one quick dip of nitric and sulphuric acid, but the plate will be discolored. Aluminum salts in a tin solution will not make it acid-resisting.—JOSEPH HAAS.

A Metals Retrospect

How Research Developed the Non-Ferrous Metal Industries

Written for The Metal Industry by W. M. CORSE, Metallurgical Engineer

The development of non-ferrous metallurgy since the beginning of the century is so closely connected with research in industry that the two are as inseparable as the Siamese twins. And, to follow our figure further, neither could thrive without the other.

In order to gain a clear picture of the developments in non-ferrous metallurgy, and to comprehend the place that non-ferrous metals occupy in the industrial world today, one needs but to blot out of consciousness a world without the telephone, radio, automobile, electrical equipment and power stations, airplanes, dirigibles, modern plumbing, builders' materials and other things too numerous to mention, because these things have all been largely developed through the use of non-ferrous metals and their alloys.

W. M. CORSE
Metallurgical Engineer

NICKEL

Nickel is one of a group of non-ferrous metals that first showed the results of intensive research. In 1900 and for a decade succeeding, its principal uses were in ordnance, bridge building materials and the automotive uses of nickel steel. Its minor uses were in German Silver, nickel plating and coinage. Then came the World War and a four-year period of high pressure production for war usage. Finally the Disarmament Conference swept the market away.

At this point research steps into the nickel picture. Careful, painstaking research conducted by trained workers in a well-equipped laboratory, coupled with intensive sales development wrested victory from defeat. Processes were perfected and a 99.9 per cent pure nickel was eventually produced. New uses were developed and the market was recovered. R. J. Stanley, President of the International Nickel Company, recently stated, "In 1926 with a larger total consumption, the nickel used throughout the world for military and naval purposes was probably not over 10 per cent of the whole. (At least 60 per cent had formerly been used in war materials.) The large use of war materials has been replaced by industrial applications." So complete a right about face from materials of war to peace time uses has probably never be fore been witnessed.

From three substantial outlets in 1900, namely, structural steel, nickel plating and coinage, nickel has eight today as follows: Malleable nickel, nickel steel castings, nickel bronze, corrosion resistant steels, ferro-nickel alloys, nickel cast iron, and miscellaneous alloys, such as solid nickel silver, white gold and aluminum, etc. Today one is rarely out of contact with nickel from dawn to dark and dark to dawn. A nickel alarm clock is likely to start one's day; bathroom equipment and fittings contain nickel. The dining table owes much of its charm and utility to nickel. It is no mean factor in kitchen and laundry. Automobile manufacturers, railroads, canneries, shipbuilders, and jewelers are using nickel. Add to these the aircraft and radio industries and even then we have not mentioned all of the outlets for nickel; and the end is not yet by a long distance.

COPPER

Copper and its alloys brass and bronze have had a certain field of usefulness for years, but the post-war period has witnessed a decided increase in their use.

"The demand for more comfortable living standards—the idea of pressing the button and letting electricity do the work," says W. H. Bassett, "stimulated the manufacturer of copper and its alloys." Research has resulted in the production of 99.9 pure commercial copper within recent years. New uses are being discovered daily and old ones improved. Copper wire and cable are largely used for the transmission of electrical power. Homes, municipalities and water companies have demanded brass pipe to such an extent that there has been an increase of 76 per cent yearly for the past three years. The building industry provides another large outlet in the form of roofing materials of all kinds. Copper range boilers are increasing in use. Refrigerators, radio, telephone, cables, airships, automobiles are largely dependent on copper and its alloys for their state of development and efficiency. Without copper and its alloys we would be without the luxuries, comforts and conveniences that we have come to regard as necessities.

ALUMINUM BRONZE

Among the newer copper alloys developed for engineering purposes are those known as the aluminum bronzes. These have been in commercial use only since 1913, and the difficulties of making them have led many engineers to condemn them. These alloys have been subjected to considerable research in this country as well as in England and on the continent. Many of the difficulties have been surmounted, at least to such a point that their value as an engineering material for certain purposes such as worm gear wheels, and where corrosion resistance is a factor, has come to be generally recognized. A year ago the Aluminum Bronze Manufacturers' Institute was formed with the object of furnishing engineers with correct information concerning the properties of these alloys, their proper uses and reliable sources of supply from which high quality products could be secured.

ZINC

Until quite recently zinc has not had an entity of its own. It has appeared either as a coating of other metals or as an alloy, and has suffered under meaningless nicknames. In 1918 the American Zinc Institute set about destroying its nicknames, and zinc is now known as Zinc —not white iron or spelter. Today it falls in the quarter of a billion dollar production class, this, even though there is at present a slight market depression owing to overproduction.

The output of primary zinc in the United States in a comparatively recent report was valued at $84,456,000, and at that time slab zinc production (of the United States) amounted to 639,000 tons. Forty-three per cent of this was used for coating and galvanizing; 30 per cent

went into alloys; 14 per cent into rolled sheet, strip and plate; and 13 per cent was consumed in making French zinc oxide, lithopone and zinc salts.

An outstanding development in the zinc industry has been the perfecting of the electrolytic process by means of which exceptionally pure zinc can now be obtained from low grade ore. Heretofore pure zinc, such as Horsehead, was obtained from very high grade ore, the supply of which was limited.

A list of the present uses of zinc is formidable when contrasted with the commercial uses at the beginning of the century, which were principally galvanizing and sheet zinc.

The printing industry consumes zinc. Laundry, farm and heating equipment all use large quantities of sheet zinc in the form of roofs, tanks, troughs, garages, tubs, silos; in fact everywhere that atmospheric corrosion is a factor there zinc finds a place.

Corrosion costs this country $3,000,000,000 a year, and there is plenty of room for every non-ferrous alloy to do its bit. The problem is, in fact, one of the right material for the right place, and Research is the handmaiden to depend on for solution.

Zinc in non-metallic forms is being increasingly used today in cosmetics, mechanical rubber toys and automobile tires, and other like commodities. It also finds wide use in pigments, for paint, lacquer and linoleum, and this latter field is growing larger every year.

ALUMINUM

Research and development on our new common metal aluminum is beyond the comprehension of those who have not come in contact with it. It is only when one has been fortunate enough to visit the plants of the Aluminum Company of America, at Cleveland, Ohio, and New Kensington, Pennsylvania, and talk with Dr. Jeffries and Mr. Stanley in their casting division, or Mr. Frary and Mr. Blough, in charge of rolling and fabrication, that one fully comprehends the rapid advances made in the last quarter of a century.

The nameless intruder in the family of commercial non-ferrous metals twenty-five years ago has become the basis of a stupendous business due to the efforts of highly trained research workers in elaborately equipped laboratories, supplemented by the tireless efforts of an active sales force.

The uses of aluminum are legion. It is rapidly becoming an essential product in the construction of railway cars, interurban equipment, airplanes, dirigibles and furniture. Sales of aluminum collapsible tubes are doubling yearly; wire, rod and bar are finding increasing use. It is used in cooking utensils, shingles and nails. It is finding increasing use in radio equipment and is replacing tin in foil, the use in this field increasing about 150 per cent in the last two years. Aluminum bronze powder is well known as a paint pigment with high reflective qualities.

Aluminum sheet for use in the aviation industry, such as Alclad, which was introduced this year is the high spot in recent development. This is an alloy that combines the corrosion resistant properties of pure aluminum on the surface with high strength and stiffness, for it consists of a heat-treated aluminum alloy base with a smooth, dense, non porous surface of very pure aluminum of uniform thickness, alloyed and integral with the core.

LEAD

Lead is the Cinderalla among metals. A thousand, a hundred, twenty-five years ago and today we find lead performing the commonplace and rather ordinary services of the various engineering industries. It contains, conveys and protects by its softness and non-corrosive qualities. Lead pipe comparable in purity with lead pipe manufactured to day conveyed water to Roman baths, and lead pipe still performs the task of conveying water.

Malleability and resistance to corrosion are two of its outstanding characteristics, and it occupies a large and secure place in industry with no spectacular fluctuations from year to year, but, rather, a steady development along existing lines. It is exceedingly useful in the chemical industry for lining tanks where corrosion resistance is a factor, and it continues as a standard cable sheathing. Lead as a shock absorber is a distinctly post-war development. Lead mattresses to neutralize vibration were first used by structural engineers in skyscraper construction about 1918. The experiment was successful and today the recently completed Graybar Building, in New York City, rests on lead mattresses, as will the New Union Station in Buffalo, New York.

In its non-metallic forms, such as pigments for paint, there is a wider use every year. Not the least of the attractiveness of modern surroundings is due to the protective paints.

CHROMIUM

Of Chromium, which is essentially a non-ferrous product it might be said, "When is a non-ferrous metal not a non ferrous metal." The addition of 14 per cent of chromium to iron gives stainless iron and steel, and 28 per cent gives chrome iron. The addition of 18 to 20 per cent chromium, 8 nickel to an iron base gives an alloy more non-corrosive to many chemicals than the alloys without nickel, and confers properties which compete with our better known anti-corrosive metals.

As a material for plating chromium bids fair to become a large factor because of its hardness. The last year saw the clearing up of the patent situation, and the most important patents consolidated in the United Chromium Corporation, whereupon chromium plating took a fresh leap forward. Leap is a good word—nothing less than seven league boots would account for the progress made since the patent situation was cleared up.

Stellite, another product of the Union Carbide Company is a hard, non-corrosive alloy of cobalt, chromium and tungsten which has found a definite place in the machining of cast iron, and lately it has been applied by a process known as "Stelliting"—a development of the last few years—whereby the metal is flowed onto steel or other metal in thin layers by means of an oxy-acetylene torch.

SUMMARY

The object of this article was to give a picture of the developments in non-ferrous metallurgy, and the part research and sales development have played therein for the last quarter of a century.

We have seen that the nickel industry performed a right about face; that copper has progressed to such a point that everybody now recognizes the economy and advantage of installations of copper and its alloys, whereas comparatively few were aware of it not so many years ago. Zinc has had its name cleared and taken its place in the quarter of a billion dollar class. Lead, the Cinderella, carries on and has added to her other duties that of shock absorber. Aluminum, the intruder, has earned the right to a high place in the sun, and chromium is wearing seven league boots. These advances could not have come about, it is safe to say, without the aid of Research—and the reader will notice that each of the major industries herein mentioned is backed by an efficient research laboratory.

However, the necessity and profit of research is not

Metal Industries of the United States

A Statistical Survey of the Metal Producing and Working Plants

WASH. F-53 M-32 P-13 S-1 J-20
IDA.
MONT. F-12 M-11 R-2 J-3
N. DAK. F-1 M-1 P-2 J-4
MINN. F-68 M-52 P-48 S-4 J-28
ORE. F-33 M-22 P-13 S-1 J-8
F-8 M-8 J-3
WYO. F-3 M-2 P-1
S. DAK. F-5 M-5 P-1 J-2
WIS. F-132 M-92 R-2 P-168 S-4 J-28
MICH. F-215 M-147 R-8 P-283 S-15 J-42
CAL. F-144 M-91 P-136 S-11 J-101
NEV. F-5 M-5 J-2
UTAH F-13 M-9 P-4 J-6
NEBR. F-20 M-14 P-11 S-2 J-12
IOWA F-55 M-38 P-29 J-20
COLO. F-20 M-11 P-8 S-4 J-20
ILL. F-244 M-131 R-9 P-519 S-43 J-230
IND. F-106 M-69 P-166 S-11 J-30
OHIO F-300 M-190 R-6 P-557 S-33 J-77
KANS. F-28 M-22 P-10 S-1 J-5
MO. F-69 M-41 R-1 P-148 S-22 J-32
ARIZ. F-9 M-6 J-1
N. MEX. F-3 M-3 J-1
OKLA. F-23 M-15 P-5 J-6
TEX. F-56 M-43 P-25 S-2 J-10
ARK. F-15 M-13 P-2
LA. F-23 M-23 P-12 J-6
MISS. F-19 M-17 J-1
ALA. F-38 M-26 P-9 S-1 J-6
KY. F-31 M-25 P-38 J-10
TENN. F-54 M-42 P-31 S-1 J-2
GA. F-53 M-45 P-8 S-2 J-3
FLA. F-22 M-19 P-7 J-3
S.C. F-18 M-15 P-2 S-1 J-1
N.C. F-52 M-39 P-4 J-6
VA. F-49 M-36 P-17 S-2
W. VA. F-34 M-29 R-2 P-25 S-1
PA. F-360 M-285 R-11 P-428 S-37
J-977
J-140
N.Y. F-333 M-226 R-15 P-876 S-37
J-5
J-1
MD.
DEL.
N.J.
VT. F-12 M-8 P-5
N.H. F-21 M-12 P-16 J-2
ME. F-22 M-19 P-14 J-4
MASS.
CONN.
R.I.
F-7 F-151 M-87 P-436 S-29 J-242
F-36 M-16 R-3 P-113 J-326
F-109 M-61 R-32 P-420 S-7 J-46
F-141 M-81 R-16 P-230 S-25 J-227
F-11 M-8 P-7 J-1
F-36 M-23 R-3 P-61 S-4 J-23
F- Brass & Aluminum Foundries
M- Brass Machine Shops
R- Brass & Aluminum Rolling Mills
P- Plating, Polishing, Japanning & Lacquering Shops
S- Secondary Smelters & Refiners
J- Manufacturing Jewelers

generally comprehended even yet. Dr. C. E. K. Mees, Director of Research for the Eastman Kodak Company, says that the results of research are intangible at first. It takes five years for a research department to find itself, another five years for it to become recognized as a valuable asset, but in the third five year period the successful research department becomes the governing mechanism of the whole factory.

Fifteen years is a long time to wait, and it is not to be wondered at that many concerns have not the courage to embark in the boat of research. However, investment bankers are becoming more and more particular about guarantees for future dividends and the company looking for loans finds it easier to negotiate them if the Research Department looms large in the picture of its assets.

I have had space to mention only some of the high spots of the developments in the major divisions of the non-ferrous field—developments so closely linked with research that they cannot be considered without it. In each instance mentioned research has meant success, and it would seem that those concerns who doubt the value of research will wake up to find themselves outdistanced as did the aviators who found Lindbergh in Paris while doubters were saying it couldn't be done.

Metal Industries of the United States

The Distribution by States of the Metal Producing and Working Plants

On the page opposite is a map of the United States subdivided into states. The metal industries are listed in each state and the number of plants are shown with these listings.

An analysis of the plants engaged in the working of metals is as difficult as the determination of the ancestry and genealogy of the average American. The industries outside of iron and steel are widely diversified, and in a great many cases are departments of general manufacturing companies. To go into fine detail in these figures would mean statistics for metal producers, metal refineries, metal dealers, rolling mills, brass, bronze and aluminum foundries, die-casters, brass finishers, brass, bronze and aluminum workers, zincers (galvanizers), tinners, sheet metal workers, spinners, stampers, platers, polishers, coppersmiths, silversmiths, manufacturing jewelers and art metal workers.

For the sake of simplicity, and at the same time to give a good idea of the extent and distribution of the metal industries, the trades as a whole have been classified into (1) metal foundries; (2) machine shops or "brass finishing" shops; (3) rolling mills; (4) plating, polishing, japanning and lacquering shops; (5) secondary smelters and refiners; (6) manufacturing jewelers.

As a matter of general interest, perhaps sentimental but nevertheless not unimportant, it should be noted that some of the metal manufacturing plants have a record of existence in business of 100 years or more. Perhaps the outstanding example is Hendricks Brothers of New York and Belleville, N. J., which was organized in 1764.

The centers of concentration of the various industries are easy to pick out. In some cases the smaller states of course, thickly populated have the most manufacturing plants. New England leads in fabricated brass and jewelry. The Middle West has the largest number of brass foundries. It is noteworthy, however, that the South is growing rapidly in industry. The middle Atlantic states like New York, New Jersey and Pennsylvania, are of course high on the list. Jewelry manufacture is carried on mainly in New York, Rhode Island, Massachusetts, New Jersey, Illinois, Pennsylvania and California.

The metal industries are largely secondary in character, depending for their existence upon the great industries which serve the public. Automobiles, railroads, building, electric light and power, electrical appliances, jewelry and hardware supply the bulk of the demand for metals.

The metal stamping industry is practically impossible to segregate as the stamping shops, to a great extent, work on steel and metal indiscriminately. Conspicuous exceptions to this rule, however, are the large brass cutting-up shops attached to the rolling mills of Connecticut, such as the American Brass Company, The Chase Companies, the Scovill Manufacturing Company and the Bridgeport Brass Company. Also there are large copper and brass plants at Rome, N. Y., and in the middle western centers, with extensive shops engaged in the manufacture of sheet metal specialties.

Arsenical Copper Research

E. L. Rhead surveyed recent metallurgical research in his presidential address before the Metallurgical Society at Manchester, England, recently. After pointing out that many of the old prominent smelting processes were now almost extinct, President Rhead mentioned the great development that has taken place in the production of certain non-ferrous metals, including aluminum and magnesium and their alloys.

Dealing with new work under his own supervision, he gave details of experiments conducted to illustrate a vital point in the behavior of arsenical copper under the action of hot gases containing chlorine. Copper alloyed with various percentages of arsenic of 0.8 to 0.1 was taken and submitted to the action of inert gas containing from 0.2 to 0.05 per cent of chlorine during prolonged periods at a temperature of 300 degrees C., selected because at this temperature the chloride of copper is not volatile, while that of arsenic is. In this way it was definitely established that the arsenic-rich eutectic surrounding the copper grains in the alloyed metal was preferentially attacked and the arsenic removed by volatilization, thus leading to a very marked disintegration in the metal. This was taken to indicate the reason for the attack of commercial arsenical copper in the form of tubes and plates by the gases from coal-fire flames under certain circumstances.—A. C. B.

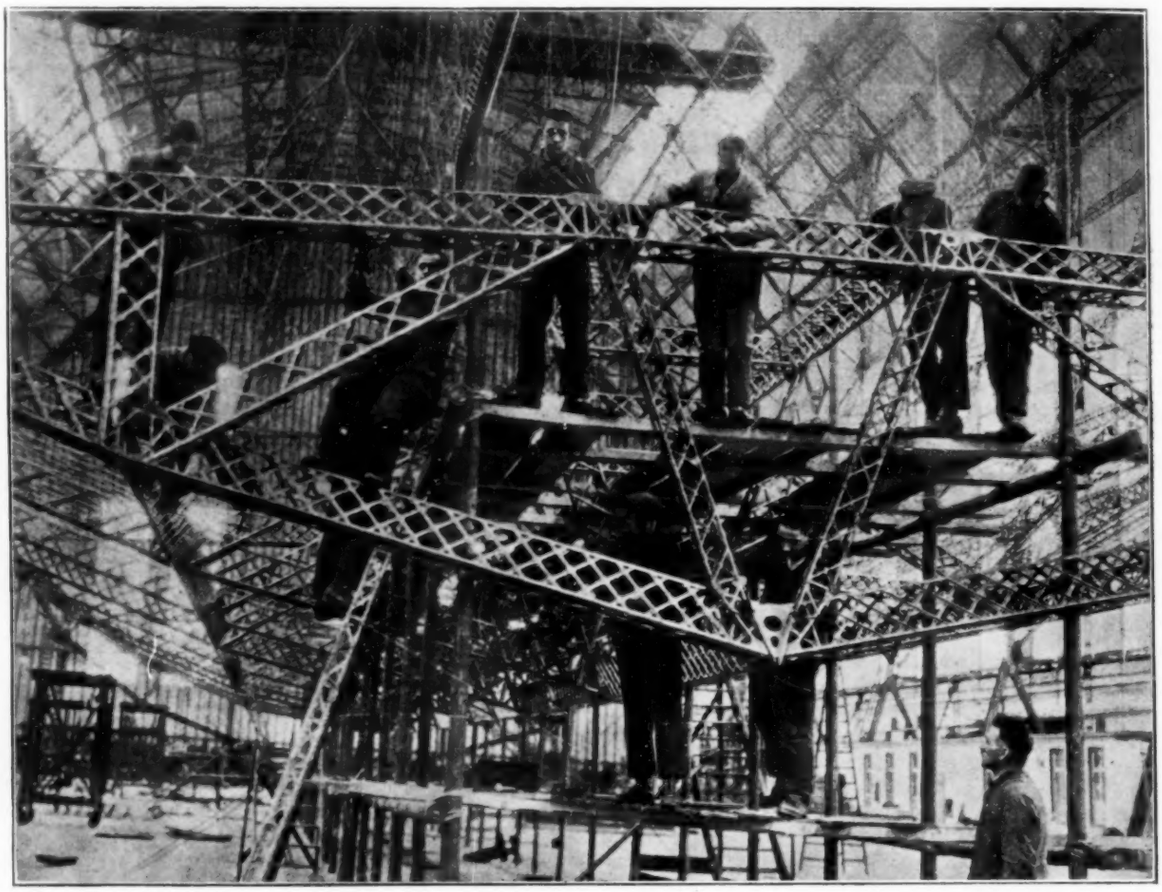
British to Award Prize

It has been decided that the ninth award of the British Institution of Mechanical Engineers' Water Arbitration Prize, worth about $150, will be made in February, 1929, and will be for the best original paper on the "Utilization in Engineering Production of the Plastic Properties of Metals" accepted for publication in the Institution's "Proceedings" during the years 1927 and 1928. The title is intended to cover the manufacture of articles by methods other than cutting, such as stamping, extrusion and rolling. All papers must be submitted before April 1, 1928. —A. C. B.

Giant Airships Use Aluminum Alloy Construction

The illustrations below show clearly how vital aluminum is in airship (dirigible) construction. The framework is of structural Duralumin, 17 S metal or similar alloy; about 4 per cent copper, 0.5 per cent manganese, 0.5 per cent magnesium, balance aluminum.

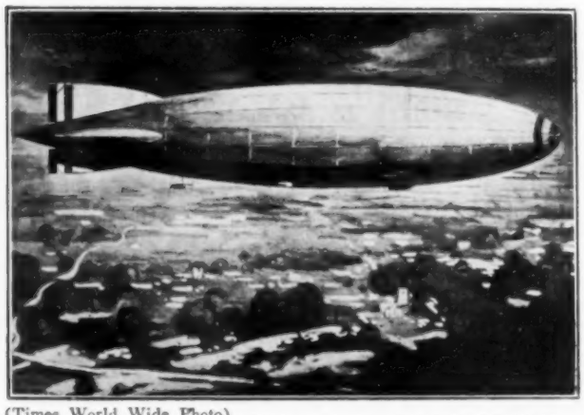
haven to establish a regular trans-Atlantic service after a proposed maiden flight around the world. The new airliner, the LZ-127 will use gas instead of liquid fuel. The gas weighs about as much as air and it is expected to develop a much wider range than heretofore possible.



(Times World Wide Photo)

FRAMEWORK OF THE NEW LEVIATHAN OF THE SKIES

Germany is building giant Zeppelin to fly around the world. Under the direction of Dr. Hugo Eckener, famous German airship designer and builder, who piloted the dirigible "Los Angeles" to America, the largest and latest of the Zeppelins with all the newest improvements is now being constructed in the great plant at Friederichs-



(Times World Wide Photo)

ENGLAND'S LATEST AIRSHIP AS SHE WILL APPEAR WHEN COMPLETED

Fig. 2 shows the first photograph to be taken of the R 100 the 5,000,000 cubic feet ship being built by the Airship Guarantee Company at Howden in Yorkshire, England. The R 100 has a length of 709 feet and a maximum diameter of 130 feet, a designed speed of 82 miles per hour, actual displacement 156 tons.

Secretary Wilbur of the United States Navy Department has asked for an appropriation from Congress, to build a metal-clad dirigible, similar to those described above, but with 6,000,000 cubic feet capacity.

New German Aluminum Alloy

The new aluminum alloy "Aldrey" is an alloy which has been developed especially for electric power lines. It is said to be noteworthy for its tensile strength and at the same time for electrical conductivity. Tensile strength can easily be attained by suitable alloys, but conductivity is ordinarily considerably lessened at the same time, especially if pure metals are added. In the case of aluminum, however, better mechanical results are possible by heat treatment than by alloying. Duralumin, the best known of light alloys, is understood to be treated this way. —Foreign Trade Note.

Progress of Metals in 1927; Outlook for 1928

Various Metals Discussed for the Metal Industry by Leading Authorities

The Copper Industry

The Growth of Copper and the Aid Furnished by Educating the Public to Its Advantages

Written for The Metal Industry by WM. A. WILLIS, Manager, Copper and Brass Research Association

WILLIAM A. WILLIS
Manager, Copper and Brass Research Assn.

It is perhaps safer to deal with the copper situation from the standpoint of the past twelve months than to venture extensively into forecasts on the fortunes of the industry during the coming year. That there has been a decided improvement in the industry's position during the past two months is well known. Any one of a dozen reasons may be advanced for this change but my own view is that it is due to the very much improved economic conditions abroad and to a steadily increasing appreciation at home of the merits of the metal and its principal alloys, brass and bronze. True there has been a falling off in domestic consumption during the first eleven months of the year, but this has been more than made up by the increased shipments to Europe. The result is that total shipments from American refineries during 1927 will show a substantial increase over total shipments for 1926, and this is significant when we take into consideration the fact that 1926 was a peak year for peace times. The world is the American producers' market and so in judging the achievements of the industry for any given period it is only fair to deal in totals. In addition it must be kept in mind that during the last two months of the year there was in this country a period of business inaction from which all industry suffered somewhat. This was particularly so in the automobile and building fields, both normally large consumers of copper.

There seems nothing in the domestic situation, however, to cause apprehension. Copper and copper products have been pretty well established in the public mind as the peers of all commercial metals for the uses to which they are adapted. There is scarcely an industry that does not use some copper and in each industry the consumption year by year has steadily increased since 1922.

Educational and research work, such as has been carried on by the Copper and Brass Research Association, which is maintained by the industry as a whole, and also by many of its member companies as individuals, has been a factor in the creation of a better understanding of copper and its uses. The extent of this work is perhaps not as well understood outside of the industry as in it, and a few random figures may be of interest to your readers. During the five years from 1922 to 1926 inclusive, the total circulation of advertising media employed by the Association alone was 840,530,900. This was divided as follows: Newspapers 729,181,000; Magazines 105,623,000; Trade and Technical Publications 5,726,000. During this same period actual contacts were made and are still being maintained with 144,950 plumbers, sheet metal contractors, hardware dealers and other handlers of metals whose good-will is of vital importance. The Association's Bulletin started in 1922 with a circulation of 500 copies. This has grown to a circulation of more than 30,000 and the importance in this growth lies in the fact that the Bulletin is only sent to people who ask for it.

In addition the Association has issued a vast amount of literature of both a technical and lay character, has conducted surveys of scores of consuming industries, has and still is carrying on an extensive program of technical research in collaboration with scientific bodies and on its own account and, in the first four years of its existence, furnished handlers of copper, brass and bronze with more than 33,000,000 booklets and pamphlets of the character generally known as "dealer help material".

All of this work has been augmented by efforts along similar lines, conducted by its individual member companies, which have been of the greatest value to the common effort. The Association now has offices at St. Louis for middle west work; at Los Angeles for Pacific Coast work and at Toronto for Canadian work. It also is working in close co-operation with the newly formed German Copper Institute, which incidentally has been a considerable factor in the improved foreign conditions.

Industrial leaders generally are optimistic concerning conditions during 1928. Everywhere there seems to be a feeling that business will be maintained at very high levels. Copper, which enters so extensively into most industries, should draw its full share of prosperity from the good conditions which seem imminent.

Lead and Tin Progress

By GEORGE O. HIERS
National Lead Company

As with coal and oil, it has been predicted that attempts should be made to conserve lead so as to delay the time when our resources in lead ores are depleted.

In recent years considerable lead has been obtained from complex ores. Many new machines, mostly of the electrical type, have greatly reduced the cost of mining. The milling of lead ores is being accomplished by the use of improved crushers and grinders. Modern methods of flotation have led to the recovery of very considerable amounts of lead from the ores. Prior to this de-

velopment ores containing smaller amounts of lead could not be economically treated. There has been an increased use of machinery which has cut down the labor costs in smelting lead. The mechanically operated Scotch hearth is a notable advance. In working complex ores, hydro-metallurgical methods are frequently being used. There has been a recent innovation for the refining of lead whereby impurities such as antimony, tin, and arsenic are being removed by the use of caustic soda and niter.

The production of secondary lead which includes secondary pig lead and lead in alloys in the United States in the last twenty-five years has multiplied approximately five times. Recoveries are made mostly from old electric cable coverings and from old storage batteries.

The new uses of lead are not so conspicuous as the increased demands such as for the electric storage battery industry and for electric cable covering manufacture.

TIN

Conditions in the production of tin are changing somewhat. Tin ores from Bolivia, South America, are being mined and smelted in large quantities. This source has become increasingly important. During the war, such ore was smelted in the United States but the high cost of labor here resulted in the cessation of our activity in this respect soon after the war. Straits tin is still the high standard of quality. Small quantities of tin, electrolytically produced, are being recovered from the refining of primary and secondary leads by the Harris and the Thompson processes.

In the years 1916–1920 attempts were made to conserve tin by the use of substitutes. The results were not very satisfactory. Tin plate, terne plate, babbitt metals and solders involve the use of most of the tin produced. Lead-tin solders containing only small amounts of tin are being utilized more than formerly.

Zinc

By STEPHEN S. TUTHILL

Secretary, American Zinc Institute

Since THE METAL INDUSTRY came into the field which it has so efficiently served for a quarter of a century, the production of slab zinc in the United States has increased practically fourfold. This is probably not so great a percentage of increase as can be shown by some of the other metals, but a truly remarkable one when it is recalled that until the formation of the national organization of the zinc industry in 1918, few people knew whether zinc was a member of the animal, vegetable or mineral kingdom.

Since the organization of the American Zinc Institute, however, zinc as zinc has become more and more articulate and self-assertive, until today it is one of the best known of the non-ferrous metals.

STEPHEN S. TUTHILL
Secretary, American Zinc Institute

When an 18-carat gold ring, which contains only 75 per cent of gold, is called by another name, it will be time for the zinc industry to consider as an alloy and so to name the metal which in its lowest virgin grade contains 98 per cent of zinc.

In passing, let me express to the editor of THE METAL INDUSTRY, the appreciation and thanks of the American Zinc Institute for his consistent efforts in behalf of the proper naming of zinc and the products of zinc.

During 1927 the statistical service of the Institute was changed from a monthly to a semi-monthly one. It now includes, besides production, shipments, stocks, exports and retorts operating at the end of the month, the following: metal sold and not yet delivered; total retort capacity; total idle retorts; average number of retorts operating during the period; also weighted average selling price (during period) of spot and forward prime western and brass special zinc, together with tonnages.

During 1927 a survey of the 1926 retort smelting cost was compiled by a nationally known firm of accountants.

An intelligent use of all this data should eventually stabilize the zinc industry to a point where, without concerted action, production will more nearly balance consumption, and where the other favorable results of stabilization will be at least approximated.

The Institute is cooperating with the Bureau of Standards in the preparation of a Letter Circular on Zinc. This Letter Circular will be fashioned after those already issued by the Bureau on copper, nickel and aluminum.

Zinc and Its Corrosion Resistance, after having been under review for nearly a year, will shortly go to press.

A representative of the Institute is now in Europe gathering final details for an authoritative work on zinc for the use of architects and artisans.

The Institute continues its active participation in the establishment of pure zinc and zinc coating standards, as briefly shown by the following:

Tentative specifications for rolled zinc have been issued for criticisms and suggestions.

Standard specifications for zinc coated sheets became effective last June.

The American Engineering Standards Committee Sectional Committee on Specifications for Zinc Coating of Iron and Steel is making excellent progress in fixing zinc coating standards for all other forms of such material.

Three important economic developments in the zinc industry since the founding of THE METAL INDUSTRY have been: (1) The opening of the Joplin-Miami zinc field, containing the greatest deposits of the ore in the world; (2) the development of electrolytic zinc; (3) the development of the selective flotation process for ores.

Not long ago 50 per cent of the slab zinc made in this country was used for zinc coating (galvanizing) purposes; in 1926 it was 46 per cent; in 1927 it was probably 40 per cent.

In view of a shift from the east to the west of a part of the zinc ore and metal supplies, it would not be surprising to see a greater interest being shown in the zinc coating development by the ore and metal producers adversely affected by such a shift. Thus might be re-established the status quo of not long ago.

During 1927 there has been a loss of zinc business done in some sections and a gain in other parts—with a net zinc metal volume output of about 4 per cent under 1926. What was true of zinc in 1927 was also true of many other industries in that year.

* All figures are approximate for the reason that actual figures are not yet available.

Aluminum in 1927

By ALUMINUM MAN

Do people in general realize that in the past thirty-five or forty years the commercial world production of aluminum has increased from nothing up to something like 425,000,000 pounds per annum? If this fact is known, the next question which naturally arises is "Where does it all go?" Most people, when thinking of aluminum, invariably associate it in their minds with cooking utensils. This is a use to which aluminum is eminently suited and many millions of pounds of aluminum go into the manufacture of cooking utensils each year. On the other hand, aluminum is found in many other everyday applications if one only knows where to look for it.

During 1927 there are two things which stand out very clearly insofar as aluminum is concerned. One of these is a single development of more or less particular application and the other is a more general development with a wider application. We refer to the introduction and development of Alclad aluminum and the very wide use of aluminum and its strong alloys in the transportation field. Alclad is a heat treated aluminum alloy base with a surface of pure aluminum.

The three important characteristics of Alclad are its light weight, strength and ability to resist corrosion. By virtue of these three points it is primarily of interest to aircraft manufacturers. With the development in this country of air mail service and commercial transportation, we have in use a number of planes which must be available at any time for immediate service. Naturally the physical maintenance of such equipment is a question of considerable moment, so that any material which can be used in their construction and which will not only give the light weight and strength which is so essential to heavier than air flying machines, but will in addition provide maximum resistance to deterioration, is certain to be in great demand.

The second development for 1927 is the ever increasing interest in and use of aluminum and strong alloys of aluminum by those who primarily concern themselves with transportation, whether it be railroads, street railway companies or bus manufacturers. When any sort of transportation equipment can be reduced in weight without sacrifice in strength, we have the logical sequence of decreased operating cost in addition to the added advantages of more rapid acceleration and deceleration. This is not merely theory, but has been proved by actual tests under normal operating conditions and anyone who attended the American Electric Railway Association convention at Cleveland, in October, 1927, will recall the important part which aluminum and strong alloys of aluminum played in the exhibits.

Aluminum furniture, while not new, is nevertheless important in that it is developing very rapidly. Here again we find that strong alloys of aluminum are used. The present chairs are not only of attractive designs, but are also light and extremely rugged, and give remarkable results under the most severe laboratory tests especially designed to test their strength and longevity.

In the washing machine industry also aluminum and its alloys are gaining in favor. Here it is found in a wide variety of places in the form of sheet, castings (sand, permanent mold and die castings), forgings, screw machine products, and so forth.

There is one final development to mention, and that is the introduction in 1927 of aluminum mason jar caps. They have been most enthusiastically received, and the demand for them is increasing all the time. While at first glance this may not seem very important, the potential business in mason jar caps will amount to something like 10,000,000 pounds of aluminum sheet annually.

To sum up, the main developments in aluminum for 1927 revolve around the increasing interest in and use of aluminum strong alloys. Research is constantly being carried on to develop further and perfect these most important products. The year 1928 shows every promise of an even greater demand for aluminum and its strong alloys, wherever light weight and strength are desired.

The Recent History of Nickel

By WILLIAM B. LAWSON

General Manager of Sales, The International Nickel Company, Inc.

Just as the consumption of pig iron may be taken as the measure of a nation's industrial prosperity, so the consumption of nickel which goes into armament enables us to estimate the extent of nations' preparation for war. Armament manufacturers took over 50 per cent of the nickel produced during the first years of the twentieth century, and their demands steadily increased with the approach of the World War. In 1913 world production was approximately 26,500 tons and, although exact figures are not available, it is practically certain the bulk of this nickel was used for naval or military purposes. Today, with world production approximating 39,000 tons, military and naval consumption is estimated at less than ten per cent of the whole.

WILLIAM B. LAWSON
General Manager of Sales,
The International Nickel Company, Inc.

The nickel industry is essentially an industry based upon the needs of peace. The narrow markets provided by manufacturers of armaments have given place to the wider fields of industrial application. The stable base of economic needs has replaced the unstable base of political considerations. So rapidly and so well has the transition been made that it is doubtful whether any of the metal industries are less subject to the effects of industrial depressions in particular fields than are the nickel producers today. This fortunate position may be explained by reviewing briefly the history of the industry during the last seven years.

The year 1921 was the blackest year the nickel producers ever experienced. The combined effect of the post-war depression and the Washington Disarmament Conference caused the markets

for nickel to dwindle to almost insignificant proportions. Consumption dropped five-sixths from the peak year, leaving the producers with plants equipped for large scale production but with a market no greater than that which obtained in the late nineties.

To remedy this situation a program for building up new markets for nickel was initiated early in 1922 by the International Nickel Company. Industrial fields were explored, sales efforts and advertising were increased, and a special Development and Research Department was organized. Service and co-operation were offered to all users and prospective users of nickel bearing products, and the technical data of the industry from that time on has been steadily augmented.

Several factors operated to aid the quick recovery of the nickel industry, not the least important being the changed viewpoint of engineers resulting from the war. The pre-war conservatism had gone and the engineers had become receptive to new ideas and eager to investigate new practices and new materials. This attitude has fortunately persisted. Had it not been for the liberal and progressive spirit of the post-war engineering industry, the development of the many new uses for nickel could not have been so rapidly accomplished.

Like all other metals, nickel has derived great advantage from the rapid expansion of the automobile industry, which consumes steadily increasing quantities of nickel in nickel steel. But as this is one of the oldest as well as one of the most generally appreciated uses for nickel, readers will probably find a description of other applications of greater interest. These will be considered under their respective heads.

NICKEL SILVER

The nickel silver industry has always taken a substantial portion of the output of nickel and today accounts for approximately 15 per cent of the total production. There has been little change in the applications for this well known alloy. The chief recent development of interest is the production of compositions which can be readily hot-worked. This development secures a somewhat cheaper production, without any essential difference in the valuable characteristics of appearance, corrosion-resistance and ease of fabrication that have been responsible for its widespread use.

Nickel silver is increasingly employed for ornamental and hardware castings, automobile trim and domestic plumbing fixtures.

NICKEL ELECTRO PLATING

Nickel plating is the best known use of nickel and uses approximately 5 per cent of the total production.

Nickel plating is still more of an art than a science. The industry is largely composed of small plating shops which work under widely differing conditions. Improvements in practice through better control of plating conditions combined with improved methods of preparation of work for plating, have done much to raise the general level of work turned out during recent years.

The trend toward heavier coatings of nickel is very noticeable. Coatings as heavy as one thousandth of an inch are now being used in place of the old standard coating of one ten-thousandth, which was really too thin to last long in service. The heavier coating will retain its appearance for a much longer period, and may be expected to become a standard for many applications. The automobile industry has been the main influence in securing these recent improvements in plating technique.

NICKEL BRONZES

The first use of nickel in the brass foundry was probably in connection with the high-lead-bearing bronzes, to prevent lead segregation. The well known "Ajax plastic bronze," introduced by G. H. Clamer, initiated this development; and during recent years this particular alloy has found many uses.

The principal function of nickel in bronze pressure castings is to refine the grain and eliminate porosity. This is accomplished by the addition of quite small percentages of nickel. Nickel is used with valve bronzes for the same reason, and also to secure improved hardness and strength at the operating temperature of steam valves.

COPPER NICKEL ALLOYS

Copper nickel alloys continue to find increasing favor. "Constantan," one of the best known alloys in this group, has approximately a forty-five per cent nickel content. Its main characteristics are high electrical resistivity combined with a low temperature coefficient of electrical resistance. One of its chief values lies in the fact that it has a uniform and reproducible thermal e.m.f. toward either iron or copper. For this reason, Constantan is extensively employed for such purposes as electrical resistance, rheostats, industrial thermocouples and thermoelectric pyrometers. It is also used, though less extensively, for corrosion-resistant castings and sheet.

HEAT-RESISTANT AND ELECTRICAL ALLOYS

The heat resistant and electrical alloys fill a vital need in modern industry, and may be expected to find extended use. The main alloying elements are nickel, chromium and iron. These alloys offer great resistance to scaling and oxidation at high temperatures, are superior to steel and other alloys in mechanical properties and strength at such temperatures, and possess high electrical resistance.

The growing trade in electrical household appliances such as toasters, percolators, irons, etc., has been reflected in a steadily increasing demand for wire for electrical heating units. Heat-resistant alloys are now in general use in all high temperature construction and, in fact, in all industries using fuel. They are fabricated into such structural forms as castings, plates, sheet and pipe.

FERRO NICKEL ALLOYS

These alloys are so numerous that only a few of the more interesting can be mentioned. One of the best known groups includes those containing from thirty-two to forty-five per cent nickel, which are sold under the names of "Invar," "Platinite," and other trade names. Invar is used in measuring instruments, and equipment, and also in the compound aluminum—Invar automobile piston, in which advantage is taken of the lightness of aluminum and its excessive expansion is counterbalanced by the low expansion of Invar, the result being a net piston expansion approximately equal to that of cast iron.

Alloys where the nickel content ranges from fifty to eighty per cent have extremely high magnetic permeability at low field strengths. The well known "Permalloy," which was developed by the Western Electric Company and is used for cable sheathing, was the first alloy of this type. Permalloy has enabled the transmission rate of messages to be increased about 10 times. These alloys are also being used for radio transformers and relay work, and permit the construction of much smaller units than were previously possible.

The non-magnetic nickel-steel alloys contain fifteen to twenty per cent nickel, generally with the addition of chromium, and are useful because of their good mechanical properties and the absence of ferro magnetism. They are being used mainly in the construction of electrical machinery.

MONEL METAL

The nickel-copper alloys, of which Monel metal is the best known type, are now so well known on account of their diversified characteristics that they scarcely require

comment. Much of the recent tonnage has been used for refrigerator trim; hotel, restaurant and cafeteria equipment; bleaching and dyeing equipment; laundry machinery; and for equipment for handling steel in pickling solutions. The uses of these alloys depend upon the combination of corrosion-resistance with good appearance and good mechanical properties.

MALLEABLE NICKEL

Although nickel in the forged or rolled form has been used for over sixty years, until recently its use was limited to wire, coin blanks, and a few cooking utensils. Latterly it has been extensively employed for hotel and cooking utensils, and for dairy and chemical equipment. These new uses are partially due to the development of seamless, malleable nickel tubing, for which there has long been a very definite demand.

MISCELLANEOUS ALLOYS

In addition to the foregoing there are a large number of alloys of less importance in which varying percentages of nickel are used. Many of these have few commercial applications, but some are staple alloys which have a considerable sphere of use. The aluminum die cast alloys and "white gold," are two examples of these staple alloys. The addition of fifteen to twenty per cent of nickel to gold produces a white gold with the appearance of platinum. This alloy has become very popular during the last few years and replaced much of the yellow gold previously used by the jewelry trade.

THE FUTURE OUTLOOK

Although the restoration of the prosperity of the nickel industry is now an accomplished fact and consumption is rapidly approaching the height reached during the war years, there are so many applications for nickel that numerous fields still remain relatively undeveloped. An expanding market may be expected for many years, quite apart from the natural growth due to an ever increasing world population and a rising standard of life. It is satisfactory to reflect that those Ontario ore deposits which have already been discovered are ample to take care of the future needs of the world for well over a hundred years.

The stability of the nickel industry is thus definitely assured for the immediate generations. Backed by the proved soundness of its present market development policy, one may reasonably look for a widening sphere of usefulness for nickel and the nickel alloys.

The Precious Metals

By C. M. HOKE
Consulting Chemist to Jewelers Technical Advice Company

It is fair to say that there have been as many changes involving the precious metals during the last twenty-five years as during the previous twenty-five centuries. In methods of mining and metallurgy, in uses of the finished product, and in certain financial aspects, the changes have been well nigh revolutionary.

C. M. HOKE
Consulting Chemist to Jewelers Technical Advice Company

MINING AND METALLURGY

In the mining, metallurgy, and ultimate refining of gold and silver we see the same tendencies that appear in other industries: larger units of production, and the application of scientific research to all processes. Thus we find the small smelters replaced by enormous ones; we see ore that was of so low a grade, or of such composition that it could not be worked twenty-five years ago, now being handled by new and intricate processes of separation, flotation, electrolytic refining, and so on, and yielding huge profits. New methods of handling crude copper, nickel and lead, are now yielding quantities of precious metals as by-products. The ultimate refining of gold and silver, formerly done by acid parting, is now done much more cheaply and efficiently by electrolytic methods—the Moebius and Wohlwill processes, the result of highly skilled chemical and physical research—with platinum and palladium as by-products.

The mining and metallurgy of platinum have also become a large-scale industry. The dredges used represent large financial investments. The purification of the crude metal does not differ in principle from the purification used twenty-five years ago, but details in the complex chemical processes have been carefully studied and improved. The history of the other platinum-group metals, especially iridium and palladium, is fascinating reading, which unfortunately cannot be included in this brief review.

PRICES

With the price of gold fixed by law at $20.67 per ounce, we have no fluctuations to account for. But since the price of almost everything else has risen, that of gold is relatively low. This has been an incentive to research in the chemical and engineering phases of mining and metallurgy, with the purpose of utilizing by-products and reducing the cost of operation.

Silver sold from 50 to 55c. per ounce in 1902. The price rose sharply with the beginning of the war, reached its high of $1.37½ in 1919, then dropped sharply with the post-war deflation to 58c. in 1921. There was another interesting drop in 1926, due to the report of the Royal Currency Commission which recommended that India change from its silver standard to a gold standard. While the change has not been made, and may never be, the report was followed by the sale of considerable metal, and the market is still low.

In 1902 platinum was an obscure metal, selling at about $19 per ounce, and having a limited application in chemistry and electricity. In about 1908 it began to acquire vogue as a jewelry metal in Europe, and the price began to rise. By 1914 the fashion was well established in the United States, and the price had risen to over $44. From then on, a number of factors co-operated to cause a tremendous rise. The use of platinum in jewelry is closely related to the oxygen industry, since in order to melt the metal one must have an oxy-hydrogen or oxy-gas flame. In 1908 there were very few firms in the whole world who could melt their platinum; by 1914 the oxygen and

fuel gas were available, and the torches for melting the metal were designed and placed on sale. Soon even the smaller jeweler was melting his own platinum scrap. Then, at the beginning of the war, the combatant nations proceeded to conserve their platinum for military purposes. At the same time, prosperity in America increased the demand for jewelry. Also, chemical industry boomed, large amounts of platinum went into catalytic processes, crucibles, dishes, etc. Soon the Russian supply was shut off by war conditions. With this combination of increased demand and sharply decreased supply, the price soared. In 1918 the United States declared a platinum embargo, and fixed the price at $105.

When the embargo was lifted some of the stringency was still in evidence, and the price went as high as $160 in 1919. With post-war deflation the price dropped, and now stands at the low level of $67, partly because of the development of the new fields in Colombia and South Africa, partly because of lessened luxury demands, partly because so many fairly good platinum substitutes had appeared during the stringency, and partly because Russia is now striving to break into the market again by offering metal at a low price.

DENTISTRY

Our prosperity and our progress in medical sciences have brought about tremendous advances in dentistry. This means an increased use of gold, silver, platinum, palladium, and even rhodium. Our metallographic technique has permitted the development of new and valuable alloys, useful in the delicate yet strong constructions of the modern prosthetic dentist. Palladium is an important element in many of these alloys.

JEWELRY

Aside from the advent of platinum jewelry, mentioned above, the innovation of the period was the working up of white gold alloys. Gilding had long been used by jewelers, but the generators and other equipment involved have been greatly improved, and the chemical principles underlying the process have been studied. Quantity production has increased, and the tendency of design is toward the lighter and more intricate themes, such as are suitable for platinum, with more emphasis upon grace and significance of line than on mere bulk. The business in novelty jewelry, in which we often see real beauty of design, has become enormous.

In short, though gold and silver are among the oldest metals known to man, we see that even after all these years of civilization we can bring about a host of changes and improvements in as short a space as twenty-five years.

Platers' Rash

Canadian Medical Authority's Investigation of Its Cause, Prevention and Cure

It has long been recognized that skin affections are prone to occur among men engaged in occupations where working conditions are marked by the combination of excessive heat with either moisture or dust. Such conditions habitually exist around furnaces, in pickling rooms, and in places where electro-plating operations are conducted.

This type of rash generally occurs on exposed surfaces of the forearms, on the wrists, elbows, neck, forehead, and on the upper part of the chest, which is usually bare of clothing. It has also been known to develop on the thighs, behind the knees and on the abdomen. It is attended by a severe burning and itching which is greatly accentuated by exposure to heat, especially if sweating occurs.

A study of the control and treatment of a rash of this character was recently made under the auspices of the Division of Industrial Hygiene, Toronto, Ont., Canada; the investigation being conducted by Dr. Frederick M. R. Bulmer and Mr. E. A. Mackenzie.*

The investigation showed that this rash was worst in patients who were susceptible to external irritation such as poison ivy and grain dusts, and seemed to follow a loss of the normal protective fatty substances of the skin, inasmuch as those whose skin remained soft and moist did not seem to be affected. Men of fair complexion were found to be more susceptible than those with dark skin.

The object of the first experiments was to find out whether irritation could be caused by direct contact with a typical nickel electrolyte. This was accomplished by applying plating liquor to the ears of white rabbits. Daily applications were made over a period of several months, one ear receiving the application, the other being used as a control, but no irritation developed. An examination of the electrolytic fluid was made at the same time and showed it to be free from bacteria or fungi. These experiments and the history of the cases afforded reasonable grounds for concluding that the rash was not directly due to contact with the electrolyte.

The rash was found to be most prevalent during the summer months which indicated that heat was probably the most important contributory cause of the trouble. This supposition was confirmed on investigation. Patients complained without exception that heat made the rash worse, especially if profuse sweating was induced. A further confirmation of this fact may be noted in that the trouble is not confined to one particular trade or to one particular set of conditions.

It is well known that while normally sweat is slightly acid or neutral, after subjection of an individual to continued external heat the sweat becomes markedly alkaline. Alkaline sweat undoubtedly removes much of the protective fatty substances of the skin and greatly reduces its natural protection. There can be little doubt that this effect, when combined with an increased skin temperature, causes the skin to become so sensitive that irritation is easily produced.

The investigators, in their report, bring out clearly and forcibly the necessity for providing cool working conditions. They also recommend that patients be given, under competent medical supervision, large doses of calcium chloride three times a day in order to combat the tendency towards alkalosis. A suitable lotion, such as calamine, may also be supplied for application to the parts affected.

Excellent results were secured by this treatment; the number of patients losing time being reduced from 51 per cent to 4.3 per cent, and in most cases recovery took place while men were exposed.

From the above it would appear that Dr. Bulmer and Mr. Mackenzie have rendered a most valuable service to men working in unfavorable environments, and these are by no means confined to the plating trades. There can be no doubt that their work will have great value in eliminating other occupational skin diseases.

* The Journal of Industrial Hygiene, Vol. VIII, No. 12, December, 1926, pp. 517-527.

Progress of Electro-Plating

Technical Developments in the Past Twenty-Five Years*

Written for The Metal Industry by Dr. WILLIAM BLUM, Chemist, United States Bureau of Standards

I. INTRODUCTION

The title of this paper needs no justification, for certainly all persons associated with electroplating will agree that there has been marked progress in this industry during the past twenty-five years, even though they might well differ as to which developments are most important. Instead of attempting in this brief review to enumerate the specific advances, an effort will be made to give a bird's-eye view of the conditions twenty-five years ago, today, and tomorrow. As the writer has been directly associated with this field for only fifteen years, the early picture is based largely upon observations of others, both written and verbal. As will be seen however, the most rapid progress has been made in the latter part of this period, which is familiar to almost all of the platers and chemists. The effort to point out promising and desirable directions for future progress necessarily involves opinions rather than facts.

DR. WILLIAM BLUM
Chemist, United States Bureau of Standards

II. THE PERSONAL RELATION

Even more important than the actual gains in knowledge and improvements in process, is the attitude and relation of the various groups affiliated with electroplating; for without the proper attitude and relation of such persons, new knowledge lies buried and useless. And it is just here that the most significant evidences of progress in this field are to be found. The relations between the plater, the chemist, the supply manufacturer and dealer, the employer and the purchasing public are today so different from those of twenty-five years ago, that even if no new facts or methods had been discovered in this interval, the industry would still have made a great advance. The fact that in specific cases there is a recognized need for still further improvement in such relations, serves merely to emphasize how much has been accomplished.

The lion's share of the credit for such progress belongs to those progressive energetic platers who in fifteen years have brought the American Electroplaters' Society to its present high standing. Through its general and branch meetings and its classes, an opportunity has been given for exchange of ideas and experiences, and for acquiring an understanding of the basic principles of chemistry and electrochemistry.

After all, electroplating is applied chemistry, regardless of whether it is conducted by a plater or a chemist. Just as the plater has learned to respect the knowledge of the chemist, that may and often does avoid or overcome serious practical difficulties, so the wise chemist in this field has come to respect the knowledge of those platers who have combined long years of experience and of study under trying conditions. Chemistry is not just coming into plating; it has always been there, though its possibilities are just being realized. There are today in this country no less than fifty chemists devoting all or a large part of their time to the study and improvement of plating, while twenty-five years ago it would have been hard to find five such persons. About a quarter of the papers presented to the Electrochemical Society during the past fifteen years are devoted to electrodeposition, including plating and refining; while in the preceding ten years the proportion of such papers was only half as great. It is evident that much more research on plating problems has been conducted in recent years than formerly. To be of industrial value however, such knowledge must be actually applied, which is now the big task of the plater. Only by cordial cooperation between the platers and chemists, of which there are now such promising evidences, can the present rate of progress be continued.

Equally significant is the change in the attitude and policy of the firms that manufacture and sell plating supplies. Large producers of the basic materials such as of copper, nickel, and zinc have within the last few years realized their opportunity to improve the quality of their products and hence of the goods plated with such metals. Secret formulas and proprietary brands have lost their value, except merely so far as trade names are symbols of high standing and reputation. The argument was frequently advanced in earlier years that it was not safe to divulge the composition of plating salts to the mass of platers because their knowledge was inadequate for them to properly use this information, and that they were likely to get into trouble if they attempted to fix the solutions for themselves! Such cases may still exist, but the large majority of platers now insist on knowing just what is in the solutions, so that they may know either from their own tests or those of a chemist, what the baths need for their upkeep. The supply houses have recognized this changed condition, and not only furnish such information to their customers, but also publish the results of their laboratory researches.

The manufacturer of the plated articles has also seen the light. Less than ten years ago it was a common complaint of platers that they could not get their employers to purchase a few ammeters or rheostats for the proper control of the plating operations. Since then, the demands for more plating and better plating, required in some cases to meet definite specifications, have led to the installation of numerous modern plants, with every mechanical and electrical convenience. Plating engineering is coming to be a recognized profession, and before long we may expect the plating department of every large factory to receive as much consideration as any other essential part of the plant.

In the last analysis all of these changes have come about because of the demands of that elusive individual, the ultimate consumer. The general public is becoming educated, even though unconsciously, to appreciate and de-

* Publication approved by the Director of the Bureau of Standards, U. S. Department of Commerce.

mand higher quality in the plating as well as in the other properties of its purchases.

The housewife no longer buys silverware to store away for the occasional guest; she uses it daily and soon learns to demand a quality and quantity of plating that will render reasonable service. In consequence there is a marked trend toward the standardization of quality of all reputable silverware.

III. PLATING PROCESSES

It is difficult to point to any important method of plating that was not at least known in essentially its present form twenty-five years ago. The formulas of the solutions used for the nickel, copper, silver, and gold have scarcely been changed; in fact some platers boast that their baths are twenty-five years old! Most of the changes that have occurred in bath formulas have been, fortunately, in the direction of simplification.

The greatest progress made in solution composition has been in the better understanding of the purpose and value of each constituent in the bath. It is here that the chemist has been especially helpful. Only through knowledge, that is still far from complete, of such basic properties as conductivity, cathode efficiency, polarization, throwing power, and crystal structure, will it be possible to predict in advance what type of bath and operating conditions will be most suitable for plating certain articles with a specified thickness of a given metal that has the desired appearance, hardness, and other properties. Such research often results in verifying, clarifying, and systematizing the present knowledge of the plater, won by hard work, but of limited value because its relations to other facts have not been established. These investigations have fully demonstrated that there is no one "best solution," e.g., for nickel plating, but that different requirements demand changes in the solution or operating conditions.

IV. PLATING EQUIPMENT

Much more striking developments have occurred in the plating equipment than in the baths. This is a natural consequence of the demand for quantity production of parts of high quality, e.g., in the automobile industry. Efforts have been made to reduce the labor item, not only to save labor costs, but also to eliminate the personal equation. Large automatic conveyor systems of plating, when standardized and properly controlled, result in a uniformity of product that is often unattainable by hand labor. Such installations are a credit to the ingenuity and perseverance of their designers. It must be strongly emphasized however that no such equipment, however efficient, can produce good plating from solutions of incorrect or variable composition. So much is at stake in a large unit, with perhaps 10,000 gallons or more of plating solution, that an even greater responsibility rests on the plater or chemist to so regulate its composition as to anticipate changes, rather than as in past years to wait for the appearance of a slightly inferior product as a sign that additions are needed. It is only through systematic analysis and pH tests, whether made by a plater or chemist, that these mechanical prodigies can function properly.

V. PLATING SPECIFICATIONS

It is safe to say that twenty-five years ago a plating specification, even if suggested, would have been treated as a joke, firstly, because there was little exact knowledge of service conditions on which to base a specification, and secondly, because few if any platers had the knowledge or equipment to enable them to meet it. Both conditions have changed. Industries are demanding that plated products meet their requirements, and are seeking, as yet unsuccessfully in many cases, to devise reliable methods for specifying and testing the quality of the plating. The platers in turn are now usually prepared to furnish at least a certain average thickness of deposit, and are also learning, though slowly, how to improve the distribution and decrease the porosity of the coatings. Actually the limited progress in this field in recent years has served more to emphasize than to meet the need for more intelligently specifying and controlling the quality of the plating. This again is a problem that demands the cooperation of platers and chemists. Its solution will do more to improve the standing and dignity of the electroplater than any other factor. Ability to really guarantee a product always commands respect.

VI. FUTURE POSSIBILITIES

From what has been said it is evident that electroplating is in a transition stage, and that we may reasonably expect more revolutionary changes in the next quarter century than in the past. Such changes necessarily involve readjustments and in specific cases may appear to work hardships. But just as in other fields, the march of progress will go on regardless of the individual, whose very survival may depend upon his adaptability to new conditions. Fortunately such changes take place relatively slowly, and thus offer opportunities for the necessary adjustments by individuals. If we could, to some degree at least, forcast the "weather" in the electroplating field, the wise "mariners" might trim their sales accordingly.

The two outstanding questions are "How much electroplating will be done in future years?" and "Who will do it?" Obviously the first is the more important, since there would be no need to answer the second if electroplating were doomed to be superseded by other methods of metal finishing.

Such a possibility is not to be too lightly disposed of. There is no doubt that the purely ornamental and artistic phase of plating, the so-called "metal coloring," is on the decline, principally because equal or superior results (from the standpoint of the consuming public) can usually be obtained by the use of colored lacquers. The metal spray process, though not yet extensively applied, may be improved sufficiently to compete in certain fields with electroplating. The recent successful electrodeposition of rubber suggests the possibility that it may be used instead of metal plating for specific purposes.

The very general adoption and high value of nitrocellulose coatings such as "Duco," for finishing automobiles and other metal products, at least put electroplating on the defensive, especially as to quality. It has been authoritatively stated that the improved service of these automobile lacquer finishes has stimulated much of the research on nickel and chromium plating in the effort to obtain on the plated parts of automobiles a metallic finish of equally permanent value. The recognition of the relatively inferior protective value of nickel plating as formerly applied has come none too soon. The progress made, however, in recent years in improving the quality of nickel plating may be taken as a fair indication that plating can meet the new standards of industry. Only to the extent that it does so can it be expected to continue its present applications, much less to extend them. Therefore, the first duty of everyone interested in the future of electroplating is to encourage all contributions from whatever source, that will permit its possibilities to be realized and extended.

It is obvious that these possibilities can be realized only by the study and application of those principles of chemistry and physics upon which electrodeposition rests. The average plater has neither the scientific education the

equipment, nor the time, to conduct such researches. He can, however, do much to test and apply the conclusions. Failure to do so is as culpable as unwillingness to install all the modern electrical and mechanical devices. Co-operation in testing the applicability of such principles to present or to other feasible conditions of plating is of value not only to the plater who may thus improve his process but also to the investigator who is thus enabled to direct his researches into useful channels.

The actual operation of all sizable plating departments will involve the application of some chemistry, at least in making simple tests and analyses. Whether these are made by the plater or by a chemist associated with the plant will be determined by conditions and expediency. There is no more reason why the plating superintendent should hesitate to call upon the chemist for an analysis than he does to call upon the electrician to repair his generator, or upon the mechanical engineer to adjust his machinery. In each case the specialist is working for the plater. The important consideration is that the plater be able to go ahead after he gets such assistance from the chemist or the engineer.

How much knowledge of chemistry the plater himself will have and use will depend both on the individual and the circumstances. The platers of today may be divided roughly into three classes, not so much according to age as to temperament, and there is and will be a place for each class. In the first class are many of the older platers, old in feelings if not in years, who find themselves unable to meet these new demands, and naturally have grave concern for their future. To the extent that such persons have a large fund of practical experience, executive ability to direct the men and the work, and an open mind to absorb all new useful conclusions, even though they may not understand their scientific basis, they may expect to continue their present usefulness, though perhaps debarred from new positions of greater responsibility.

The second and largest class consists of those platers, "middle-aged" in years and attitude, who while they may not be able to study chemistry or other sciences exhaustively, are willing at a sacrifice of time and energy to attend classes for platers and to read and study the publications on plating. Their knowledge of chemistry, limited though it may be, will enable them to make simple control analyses, and what is often more important, will indicate to them when they need the help of a chemist, and will enable them to use his results.

The third class includes the assistants and apprentices of today, who will be the plating superintendents in ten or twenty years from now. Such persons should not be content with the platers' classes; they should attend more extensive courses in industrial schools, either full time for a few years or in evenings for several years. Even then their purpose should be, not to become chemists, but to know enough of chemistry and related sciences to use them directly and indirectly in all the plating operations.

The plating superintendent of the future may well be a hybrid of an executive, a plater, a chemist, an engineer, and an efficiency expert. Such a person should and we hope will, look back with gratitude to the platers of this day, who have unselfishly labored to improve the methods and conditions of plating and thus to prepare the way for the plater who is to be.

Verde Green

Q.—Can you give us any advice on producing a verde green finish on brass? The formula we have tried, without success, is as follows:

Water	3 qts.
Hydrochloric Acid	1 qt.
Vertigris (Basic Copper Acetate)	3 lbs.
Copper Carbonate	8 ozs.
Powdered White Arsenic	8 ozs.
Sal Ammoniac	3 lbs.

The best we have been able to get is a very pale green, obtained after daubing on the solution continuously for about ten minutes. At that, the green did not appear until about 8 hours later. The coating was then found to be non-adherent to the work, coming off in large flakes.

A.—Add the chemicals slowly to the acid so that gases formed have a chance to escape without solution boiling over. When all action has ceased, heat moderately for ½ hour. Allow to settle and pour off clear solution. To the clear solution, add 4 fl. ozs. glycerin. Use clear solution only and in this manner. Have two stiff stippling brushes; one completely moist with solution and rub it in vigorously on articles. Treat about 1 dozen articles at a time. Then with the other brush slightly damp with solution, stipple over the articles. The green will show up right under the second stippling. Care should be taken not to work up too dry, otherwise the verde will lift off.

The best verde greens are produced by the slowest action of the chemicals on the copper or brass base. However, by use of the following solution, used as described, a verde can be formed immediately.

Hydrochloric acid	2 qts.
Verdigris	2 lbs.
Copper carbonate	1 lb.
Powdered white arsenic	8 ozs.
Sal-ammoniac	3 lbs.

JOSEPH HAAS.

Standard Threads

Q.—Can you give us information about the United States Standard Thread. Does it refer to the shape the number of threads per inch? Has it ever been called by any other name. Also, what does U. S. F. mean as applied to thread?

A.—What is now called the United States Standard thread was devised by Wm. Sellers the founder of the company which now bears his name in about 1868. It was a very noteworthy attempt to standardize screw threads as to pitches and form by doing away with the sharp V thread and at the same time to secure the advantages of the Whitworth thread without taking over the disadvantages in the shape of the rounded tops and bottoms of the threads. This was called the Sellers thread and later the Franklin thread because the Franklin Institute in Philadelphia not only approved it but worked strenuously for its adoption by the scientific departments of the Government.

The U. S. S. thread refers to the shape and pitch, a 60° angle thread with ⅛ of the thread height flattened at top and bottom. In other words it is ¾ as deep as a sharp V thread. It also refers to the number of threads per inch for given diameters of bolts. Many of these pitches correspond in general to the V thread, the greatest difference being in the case of the ¼ inch bolt which has 13 threads per inch in the United States Standard and 12 threads per inch in the old V thread.

U. S. F. means United States Form of thread, the 60° angle and the ⅛ flattened at top and bottom, but not the specified pitches for different diameters. The French metric screw threads are U. S. F. but of pitches which are designed in millimeters instead of inches.—P. W. BLAIR.

The Bosse Process of Chromium Plating

A Control Method Developed Abroad

By Dr. W. PFANHAUSER

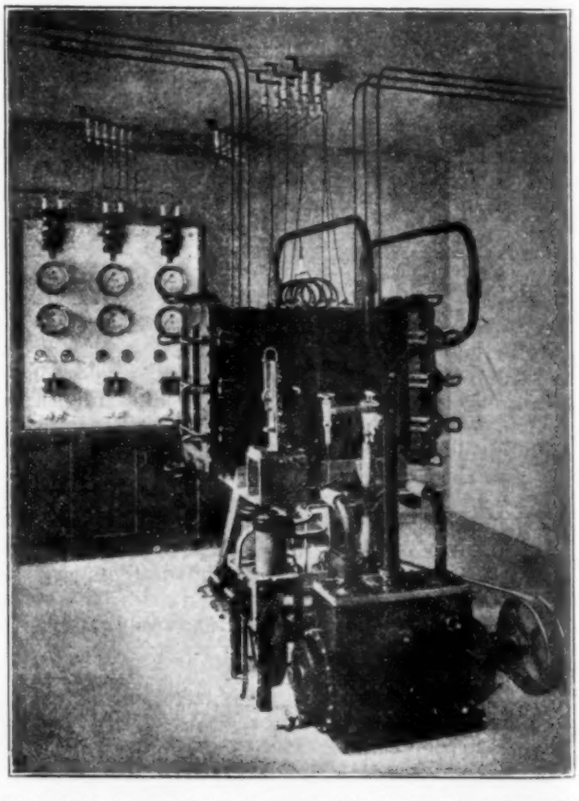
No technical process of the last decade has engaged the attention of so many research workers all over the world as the electro-deposition of chromium. In all countries investigators have worked feverishly to perfect the details connected with chromium plating. The practice of the electro-deposition of chromium has provided the technics of electro-plating with problems of a varied nature. It is interesting to note that the results obtained in different countries vary from each other in many regards. To judge by the reports given in the technical press, chromium plating, in the U. S. A., for example, is carried out with an extremely high current density, which on the one hand strongly influences the economy of the process by the enormous current consumption, and on the other hand it effects an extraordinarily brittle deposit, due to an excessively high occlusion of hydrogen. One finds statements about the current density used in the U. S. A., for the deposition of chromium which range from 200 to 500 amps. per sq. ft. This indicates a current density of about 20-50 amps. per sq. decimeter. To the German technician it is quite clear that the American does not purposely aim at such a high current density in order to shorten the period of deposition, but that he is compelled to do so by the characteristics of the chrome electrolyte there in general use.

Chrome electrolytes incorrectly compounded only give coherent chromium deposits at such high densities, and they possess, also, the serious drawback experienced in the earlier days of chromium-plating—the disproportionate permeation of the deposit. All projections, edges, etc., of the articles to be chromium plated constitute a screen against the lines of current, and behind these current screens, one may say in the "current line shadows," the current line density is too low. A result of this deficiency of the requisite current density is that no coherent separation of the chromium is possible, but only the formation of chromium oxide.

GERMAN AND AMERICAN PRACTICE COMPARED

With such compounded electrolytes one is compelled to use enormously strong currents, with a correspondingly high pressure at the vat of from 10-20 volts, or even higher, in order to obtain the requisite minimum current density, which latter is higher than that obtaining in the current line shadows. Such a method of working, however, produces phenomena which entail great difficulties for the further treatment of the deposit, *e.g.*, the formation of a dull chromium deposit which is difficult to polish. Moreover, such a method substantially increases the costs of chromium plating. The use of a good electrolyte, such as those at present in general use in Germany, enables one to chromium plate evenly and perfectly with a current density of 2-5 amps. per sq. decimeter. One may reckon upon a current consumption of about 1½ kilowatt hours per sq. decimeter of article (cathode) surfaces to be covered, in a plating process of one hour's duration. The American method demands 15-30 kilowatt hours in order to obtain the same thickness of deposited chromium in plating period of half-an-hour. Even then the deposit is in a less workable form, and is dull and difficult to polish.

It is common knowledge that in chromium plating a considerable percentage of the low voltage current is used at the cathode in the generation of hydrogen gas. This percentage is on the average 75-80 per cent. The higher the current the more the formation of vat vapors make their presence unpleasantly known. The vapors can be removed by the use of modern exhausters. Hand in hand with this generation of hydrogen, which is inherent in the separation of metallic chromium, we also observe an occlusion of hydrogen in the separated chromium. The author has determined that with a current density of about 5 amps. per sq. decimeter of separated chromium deposit, 200,250 times its own volume (measured by atmospheric pressure) is occluded. This hydrogen content, however, increases 800 times in volume with a current density of 10 amps. per sq. decimeter, and we can reach a volume 2,000 times that of the separated chromium with a current density of 20 amps. per sq. decimeter. There is no wonder that chromium deposits with such a high content of hydrogen crack and scale off the base metal shortly after its deposition. Before this splitting away takes place, air and other corrosive agents permeate through the splits down to the foundation metal, which explains the appearance of corrosion. It is clear that articles chromium plated in such an ineffective manner do not constitute good propaganda for chromium plating. It must be welcomed as a special advance that a German research worker, Dr. von Bosse, has been successful in discovering and completing a wonderful process which enables the complete removal of the hydrogen generated during the chromium plating process from the chromium deposit before the occurrence of cracks, and without involving any appreciable increase in the temperature of the plated articles. Attempts have been made to remove the hydrogen by means of a thermal treatment of the chrome-plated articles, either by heating in stoves or by dipping



CHROMIUM PLATING INSTALLATION—VACUUM APPARATUS

in molten metallic salts, such as molten lead, and the like. The invariable result of such a sudden increase of temperature is that the layer of chromium splits, and then corrosion sets in.

THE BOSSE VACUUM PROCESS

Under the new process of Dr. Bosse, the treatment is the reverse—it is a cold treatment in a vacuum apparatus (see Fig. 1) of the chromium plated articles to be freed of gas, on the principle of the diffusion of electrodes. For this purpose the articles to be treated (it is immaterial of what metal they are made) are secured to a suitable holder contrivance on the electrode rods, which are in the interior of the vacuum apparatus, in a similar manner to

THE BOSSE SYSTEM OF EXHAUSTING THE GASES DURING CHROMIUM PLATING

that which is customary in electro-plating. After the air in the vacuum vessel has been pumped out by a rapidly operating air-pump until a high vacuum has been produced, a high pressure A-C current is connected to the electrodes, whereby rays of light are emanated from the articles. The light rays convey with them the hydrogen contents, which are at once removed by the vacuum pump. In such a combination of chromium and hydrogen the hydrogen functions as a noble metal, and therefore is subject to the same conditions as, say, gold or silver. The evacuation, even of large vessels, can be effected in a few minutes, and requires only a small current consumption. The removal of the gas can be effected in 10-15 minutes in the case of a chromium layer of normal thickness. The completion of the removal of the gas can be observed by suitable high vacuum instruments. Moreover, the practised eye can observe the progress of the liberation of the gas through suitable peep-holes, as the light emitted from the articles to be gas freed alters after the gas has been completely liberated. Especially valuable is the fact that the hydrogen is not only removed from the chromium deposits in this excellent manner, but it is also completely liberated from the base metal, as, for instance, copper, brass, iron, steel, etc., which hydrogen often hardens so that sharp edges split after being chromium plated. In this wise surgical instruments, for example, retain their original hardness. The apparatus is easy to work, reliable in operation, and a valuable innovation in modern chromium plating.

Fire Hazards in Finishing Rooms

Smoking, Sparks from Nails and Static Electricity Cause Much of the Damage

By W. J. SMART

President, Eureka Pneumatic Spray Company

Too much care in guarding against fire cannot be exercised. The rules and caution of the Board of Fire Underwriters are well founded. However, there are many cases where the actual cause is not ascertained, and the blame is often placed on the spray installation, entirely without justification.

The writer has in mind a case of one manufacturer who reported a fire in spray booth. A representative, who was at once sent to investigate, examined the spray booths, and found a cigarette butt on the floor at one booth, flattened out from being trod upon. Evidently the operator had been smoking a cigarette and, upon approach of the foreman, had stamped it out. The representative called the foreman's attention to this fact, asking him if he made close observation. He answered, "Yes."

"Very well, just watch this. Get a fire extinguisher ready," was the warning.

The representative then took a cigarette, lighted it, and threw the lighted cigarette directly into the fan wheel. The result was that it was immediately lighted. He instantly extinguished it with Foamite extinguisher, having made the illustration merely to show how unknown fires may and do occur.

The great trouble is, operators will try to steal a smoke. In this case, the manufacturer immediately posted notices that anyone working in the lacquer room at any time who had either matches or cigarettes on his person or who had them in the locker room would be at once discharged, following the rules similar to those existing in the Government powder magazines, where no one is ever permitted to enter with matches on his person.

All workmen in the magazines are prohibited from wearing ordinary hobnailed shoes, it being the practice in such case to wear either rubbers, felt, or shoes which have no iron nails which could create a spark. Many factories these days have concrete floors, and iron nails in shoes, scuffling on the concrete floor, can readily create a spark, which should be avoided. Hobnailed shoes should not be permitted in lacquer or other finishing rooms.

A practice of grounding the motors when installed should be closely followed. It is advisable that the booths should also be grounded, if ventilated by belt driven fans, in order that static electricity may be taken care of. The static comb on the belt is likewise advisable.

Small matters like this will prevent serious fires at times, which may do considerable damage to property and, perhaps, life and limb. The writer strongly urges more vigilance on the part of department heads, especially as regards operators stealing a chance for a smoke, believing that inasmuch as they are standing in front of a booth, the smoke will be unseen, and that they can get away with it.

The rule prohibiting matches or cigarettes on any operator should be strictly enforced. Underwriters are justly tightening up on rules of electric wiring and equipment in lacquer and finishing booths and finishing rooms. These rules are made to protect life and property, and great importance is attached to them. Up to the present time, there apparently, is a necessity for electric motors in spray booths and rooms. The Underwriters have no disposition to cripple industry, but must use their energy to protect life and property.

In closing, the writer suggests the strong advisability of having, in convenient places, boxes of sand with a hand scoop, so that in case a fire starts it can be put out at once, sand being far better than water. A chemical extinguisher is also advisable to have handy, in case of need. Bearing in mind that an ounce of prevention is worth a pound of cure, it will be well for manufacturers to follow more closely what is going on in their finishing departments.

In some cases it is possible to have an ordinary steam pipe arranged so that the steam can be quickly turned on into spray and ventilating ducts. This practice is followed in oil refineries, steam being one of the best known extinguishers of fire.

The National Board of Fire Underwriters publish a small booklet on "Rules of Finishing and Processing Rooms," which may be had from them on request free, or procured through any insurance broker.

The Metal Plating Industry

A Review of the Electro-plating and Metal Finishing Business for 1927

Written for The Metal Industry by CHARLES H. PROCTOR, Plating-Chemical Editor

The American electroplating industry is in splendid condition and should continue so during the coming year. Perhaps among the most important factors that have contributed to the general increase in the industry are chromium, cadmium and tin. It has been a matter of only five years since these three important metals have become commercialized; chromium for its intense hardness and resistance to atmospheric oxidation; cadmium for its splendid protective value for protection against atmospheric corrosion (or rust, the great destroyer); tin for its wonderful protective value in connection with the preservation of food products, liquids, etc.

The year 1928 should be a successful year for general plating equipment manufacturers because of the tremendous demand for plated metal goods.

Chromium should be used extensively in the automobile industry for the final plating of metal parts subject to atmospheric oxidation; the treatment in preparing steel parts for the final plating of chromium being copper and nickel deposits upon the steel. In the production of interior automobile hardware, chromium plated die castings have already appeared and will no doubt be used more extensively in the future, but for the present nickel is being used as the basis of many antique finishes, such as platinum and silver gray, etc., as well as polished nickel. The vogue for antique hardware is developing so we find special names for special finishes that have no connection with the finish. Zinc and aluminum are the basic metals for these finishes, which are termed pewter gray, Swedish and Flemish iron, etc. The finishes are distinctive, so attract attention due to their novelty.

We must refer back to chromium both from the open as well as the patented basis. Splendid results are being obtained at present from both types of solutions. Work carried on under commercial production with both processes have enabled chemists and electroplaters to learn a great deal.

The patent situation in chromium plating still remains the same. Prior art established by Carveth and Curry and by Sargent must, in my opinion, still be the dominating factors of the commercial work. The corporations that control the greater part of all recent patents and the general plating public have not yet arrived at any decision as to Who is Who. As a guide to a decision in the matter, and for the benefit of the manufacturer, the chemist, the electroplater, and patent attorneys, a copy of the splendid work by Richard Schneidewind, of the Department of Engineering and Research, University of Michigan, Ann Arbor, Michigan, entitled A Study of Patents, Dealing with the Electro Deposition of Chromium, may be consulted. An abstract of this bulletin was published in THE METAL INDUSTRY for December, 1927.

In numerous other lines of production very little change has taken place in finishes.

JEWELRY AND ALLIED NOVELTY PRODUCTS

Novelty in design is the factor that keeps this industry busy. Green gold finishes, both of the light and antique green, still predominate. White gold and platinum are still the basic metals, but palladium is gradually coming back again, after more than twenty-five years. Palladium is an interesting metal. It is somewhat whiter than platinum and has non-oxidizing properties almost equal to platinum.

The price of platinum has fallen sharply in the past year. The use of white gold to such a great extent may have had some bearing on prices, but the unloading of large supplies of platinum by the Russian Government was the main factor. Roman gold, English and rose gold finishes are still in healthy demand.

STERLING SILVER AND SILVER PLATE PRODUCTS

The finishes upon products made of sterling silver and base metals plated with silver are practically identical, so we find that Butler and platinum grays still predominate, due to their soft semi-lustre. Reproductions in Period silverware have reached tremendous proportions in America. Colonial, Elizabethan and the Georgian periods predominate. Many articles of this description are completely gold plated, so gold plating in the lines mentioned is coming to the front again.

ELECTRIC FIXTURE PRODUCTS, FURNITURE HARDWARE AND BUILDERS' HARDWARE

These products are finished in endless variety. Polychrome still maintains its popularity due to the fact that so many distinctive color combinations can be produced by the air spray. But for quiet beauty and richness of finish, the products finished in old English burnt brass, Butler silver, platinum grays and Flemish and Swedish antique prevail. Gold plated finishes are coming into vogue, both in the bright, semi-lustre and antique.

Chromium is too cold ever to become an attractive finish for jewelry. Novelty goods or electric fixtures, plumbers' hardware, will eventually all be plated with Chromium, due to its non-tarnishing properties, and to its resistance to the dulling action of moisture. Nickel plated products have always been used in this line, but chronium may some day be king.

Builders' hardware finishes are along standard lines. Brush brass, antique brass, copper and bronze finishes predominate.

Period products are gradually creeping into the builders' hardware line, so old English burnt brass and Swedish and Flemish antique iron finishes are now being used extensively.

FINISHES IN LACQUERS AND ENAMELS

The manufacture of these products is constantly on the increase. Every year sees a greater number of manufacturers. Just as long as almost every kind of article used in the home, made from wood or metal, is finished in colors, so long will the lacquer and enamel manufacturing business increase.

It is only during the past few years that cellulose enamels have been used so widely in the automobile industry. Enamel finishes do not have the beauty of lustre of the old time pigments, paints and varnishes, but what the present product has lost in lustre it has gained in permanency, so it will continue to be used indefinitely.

THE AMERICAN ELECTRO-PLATERS' SOCIETY

No review could be complete without mention of the splendid work being done by the American Electro-Platers Society, the American Electrochemical Society, and the Bureau of Standards.

No organization in existence has accomplished so much for its members as the American Electro-Platers Society, and its work still continues along progressive lines.

"Knowledge Is Power"—its motto—still holds good, with the added motto for its future of "All For One And One For All." It will still continue on its way for the benefit of the industry over the entire world.

The American Electrochemical Society still progresses, still continues to do the splendid work of investigation, upon which basis, as a foundation, all must depend, when commercial results must follow under commercial production.

The Bureau of Standards, under the supervision of Dr. Blum, still continues to be a most valuable aid in cooperation with the American Electro-Platers Society, so that standards in the industry may be arrived at, and its many problems solved.

Possibly one of the most costly problems of the Industry is the spotting out of plated metal goods. The writer has tackled this problem for years, as many other co-workers have done, but it still appears periodically in one form or another.

If the Bureau of Standards' staff can solve this problem then the money that has been subscribed by manufacturers, members of the American Electro-Platers Society, and others, will not have been subscribed in vain. Keep Dr. Blum and his assistants constantly at work, until it is licked!

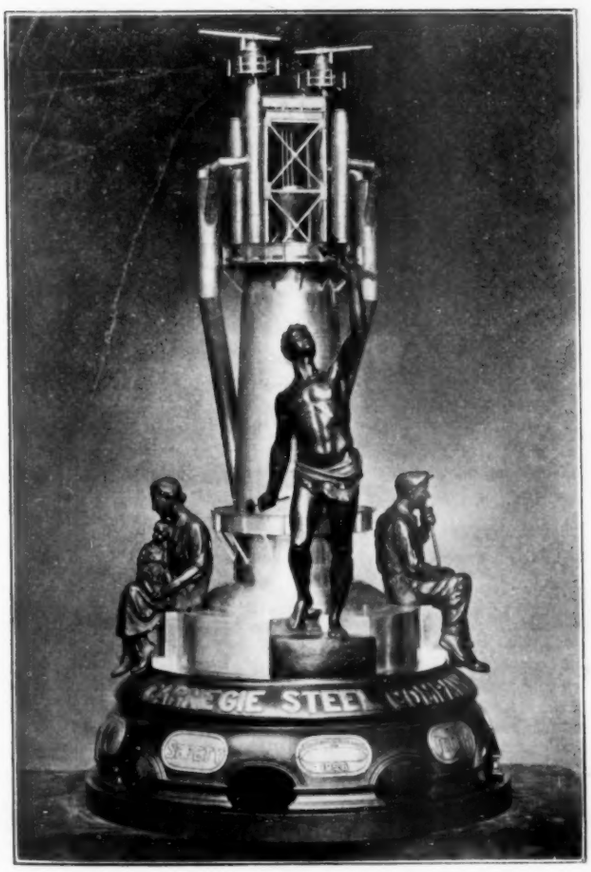
In carrying on this work, however, the Bureau of Standards' staff must seriously consider that the use of sulphide factors can never be discarded in the electroplating and finishing industry. Without sulphides in one form or another, we could not produce the commercial antique metal finishes of today.

Then let us all look confidently towards the future. Follow the sunshine as it dispels the darkness. The coming year should be bright.

Silver and Bronze Safety Trophy

Metals are the barometer of industrial activity. They are the symbol of power and progress and, more than ever today, it is the source of intense rivalry among nations that control deposits of ore and coal, for both are linked together in the kingdom of metal.

The Carnegie Steel Company originated the idea of putting industrial safety on a competitive basis, and each year it puts into competition among its manufacturing plants a safety trophy that is held from month to month during the year by the plant making the greatest percentage of reduction in lost time accidents for the preceding month, in comparison with its own record for the preceding five years, and at the end of the year it is awarded in perpetuum to the plant making the best record for the entire year on the same basis.



CARNEGIE SAFETY TROPHY

This is the second of these trophies executed by The Gorham Company for the Grogan Company, Pittsburgh.

It is of bronze and silver, thirty-seven and one-half inches in height.

The main feature, executed under the direction of the Master Silversmith, Thomas J. Docker, is a replica or miniature of a blast furnace in sterling silver, resting on a base of bronze with nine sections each with a silver label for inscriptions.

An imposing standing figure of Vulcan is the dominant figure of this composition. Vulcan was the divine personification of the fire that burns within the earth and bursts forth in volcanic eruptions—fire which has no connection with the sun or the lightning of heaven; and such being his character, we can readily understand the mutual dislike which existed between him and the god of the light of heaven.

"Those who labor
The sweaty forge, who edge the crooked scythe,
Bend stubborn steel, and harden gleaming armor,
Acknowledge Vulcan's aid."

From being originally god of fire, Vulcan naturally developed into god of those arts and industries dependent on fire, especially the art of working in metal. He was the artist god who worked in a smoky smithy down in the heart of the burning mountains, and produced clever works of dazzling beauty.

The supporting figures resting or seated on the lower plinth of the furnace are Motherhood and Labor. These models are the work of E. E. Codman, the designer.

Colored Aluminum

Q.—We desire a formula for alloys, to be used in aluminum castings, to make brass colored aluminum without a great increase in cost of production.

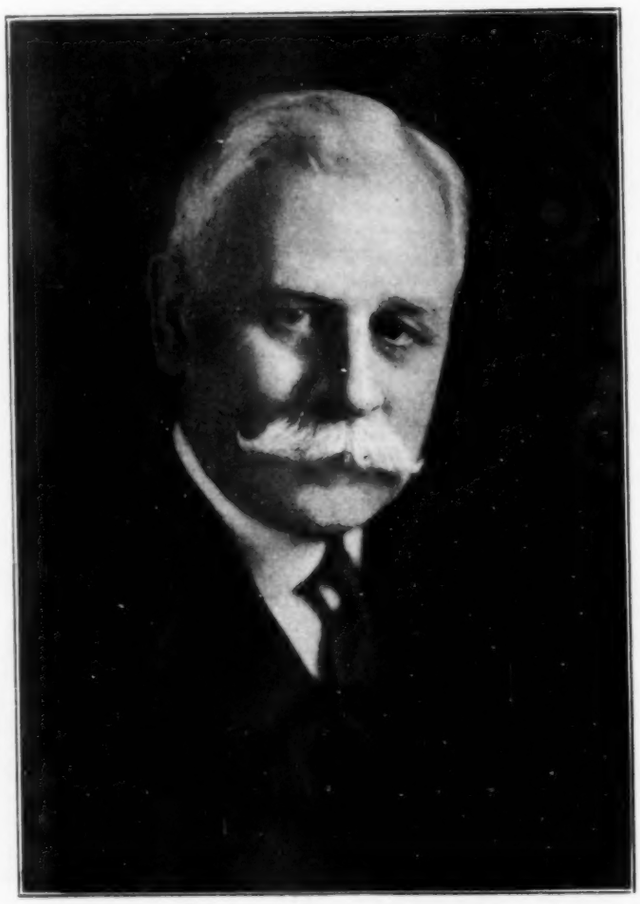
A.—There is no formula that can be used in aluminum casting to make brass colored aluminum. Aluminum can be colored any color after casting, by the plating and other processes. The U. S. Aluminum Company has a process of coloring aluminum foil different shades. We do not know the process but suggest you write them.—W. J. REARDON.

The Brass and Copper Fabricating Industry

A View of the Economic Situation by One of America's Leading Industrialists

Written for The Metal Industry by JOHN A. COE, President, American Brass Company

One cannot invariably judge the future by the past. The industry has been making very rapid strides in many directions during the period since the World War. More and more it is becoming a technical business, with trained engineers giving their attention to the needs of the consuming trade in a way unheard of a few years ago, and because of this new element much of the uncertainty and guesswork of the past has been eliminated. The engineering staffs of various consumers have established standard specifications, requiring improved quality and workmanship in order to meet the exacting conditions of the present day, and are carefully supervising all requirements.



JOHN A. COE
President, American Brass Company

The volume of business increases with the growth and development of the country and new uses for the product are being constantly discovered, thus adding to the very large line of finished products which for many years has made this one of the staple industries of the country.

The large plants used for the fabricating of copper and brass products located in New England and in other sections of the United States have contributed in a very considerable degree to the development of the particular area in which they are situated, and because of adequate transportation facilities by water and rail the manufacturers are in a position to deliver their products to all parts of this country, and at the same time to take care of the increasing export demand.

Manufacturing facilities are being improved and developed in keeping with the probable growth of the business both at home and abroad in such a manner and to such an extent as to warrant the belief that the industry will continue to grow and prosper in the future as it has in the past.

For a great many purposes copper and brass products stand pre-eminently at the head and engineers are coming to appreciate their real value, not only in the field of electricity, but also in building construction for inside as well as out-of-doors requirements.

The application of electricity to our transportation systems requires the use of non-ferrous metals in larger and larger quantities.

Altogether, in view of the recognition that non-ferrous metals are receiving in recent years for an ever-increasing number of purposes, things seem to promise well for the future of the business.

A Message from the Chase Brass & Copper Company

We are very interested to know that you are going to have the 25th anniversary number of THE METAL INDUSTRY.

Our brass mills have been goin a little longer than that, and our factory nearly three times as long, but our present business is really the result of the last quarter of a century of industry much as yours has been.

We send you our good wishes for another successful New Year, and hope that it will be a prosperous one for you. We also hope it will be prosperous for ourselves and the whole brass industry, and we believe it will be.

RODNEY CHASE.

THE METAL INDUSTRY

With Which Are Incorporated

THE ALUMINUM WORLD, COPPER and BRASS, THE BRASS FOUNDER and FINISHER
THE ELECTRO-PLATERS' REVIEW

Member of Audit Bureau of Circulations and The Associated Business Papers

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EDITORIAL

Review of the Metal Industries for 1927—Outlook for 1928

At the end of 1926 it was expected that 1927 would be a good year with the possibility of being a big year. Recessions in some industries were expected but on the whole it was felt that 1927 should show almost as good a record as 1926.

If we could divest ourselves of the "boom psychology" we should all readily admit that 1927 was as good as could be generally expected. On the whole it was not as good as 1926, falling behind it, let us say between 5 and 10 per cent; enough to be felt but not enough to cause any serious disturbance.

Some industrial concerns of great magnitude earned extraordinary profits. The troubles of 1926 would seem to have been visited largely on the small to middle-sized organizations which were not equipped with the last word in labor-saving machinery and cost-reducing methods. The price structure continued to fall slowly and gradually, but nevertheless steadily. As a result competition for sales was bitter, prices were cut to the bone and only those most adequately equipped and manned could show profits. The year 1927 brought out more clearly than ever the fact that in these days of falling prices and too large producing capacity, success goes only to the most capable, energetic and progressive organizations. The very large corporations, of course, have the largest proportion of such talent and consequently the bulk of the profits were earned by them.

METAL PRICES IN 1927

Metals as a whole stayed down or moved within narrow ranges. Copper, however, after suffering a hard year, showed decided improvement in the latter months and is now at a point where some others besides the very low cost producers can show profits. The marketing methods of the industry seem to have become organized through the Copper Exporters and the Copper Institute, and the future of the metal seems more secure than it has been for several years.

The tendency of zinc has been slowly but quite steadily downward due to some overproduction.

Tin went through its usual gyrations, rising from monthly averages of 66½ to almost 70, and falling back to 58½ cents. The tin situation is anything but clear, but a determined effort is being made to rid this country of the grip of foreign manipulation of a prime necessity which we cannot produce.

The tendency of lead has been downward all through the year but it is beginning to show signs of recovery. Aluminum has, of course, been quite steady except for two reductions in the past three months. The purpose of these reductions by the American producer is unquestionably the encouragement of wider use of the metal. The relation of prices to costs no one knows, as these figures are not given out.

Nickel has remained at the same price for about two years, but during the last month a cut of two cents was made, to 37 cents per pound, also to encourage wider use.

Silver, after its sharp drop of 1926, due to demonetization in India, held its own fairly well all year, ranging from 55½ cents to 58 cents.

Platinum, the last of the inflated metals, finally had its turn in going down. The Russian Government released large supplies which they had been unable to market at the high prices quoted and as a result platinum dropped precipitously from over $100 per ounce to a little over $60 per ounce. At the time this is written it is steady at $66 per ounce troy.

Speculative profits in metals were hard to reap. The important producers had reasonably good years but traders had their troubles.

TECHNICAL PROGRESS

The technical progress of the year can be summed up to a great extent in the work reported before the leading technical societies. In the metallurgical field one of the outstanding developments was the production of a very pure aluminum (99.8 per cent) by the Aluminum Company of America.

Another new product is Alclad, a heat treated aluminum base alloy with a smooth, dense, non-porous surface of very pure aluminum and uniform thickness, alloyed and integral with the core. This material is said to be much more resistant to moist air and salt spray than unprotected strong aluminum alloys.

Interesting work was done at the American Brass Company on beryllium-copper alloys. An important development was made by M. G. Corson in his discovery of new systems of copper alloys, including copper-chromium; copper-cobalt; copper-silicon; copper-nickel-silicon; copper-cobalt-silicon; copper-chromium-silicon; copper-iron-silicon. These alloys can be heat-treated and unusual results obtained.

The Society for Testing Materials, in addition to its regular work of broadening its list of standards and corrosion testing, has initiated work on die casting metals in an effort to standardize the alloys used in this industry. A new zinc alloy was developed by the New Jersey Zinc Company, containing 92.9 per cent zinc, 4 per cent aluminum, 3 per cent copper, and 1/10 per cent magnesium. This is a die casting alloy intended to replace the standard 92 zinc, 5 aluminum, 3 copper.

Aluminum bronze has made real strides in production methods and general pupularity. It is being sponsored by the new Aluminum Bronze Manufacturer's Institute.

Two great problems have engaged the attention of the electro-plating industry, to a greater extent than most of the others. The first and most important of these is chromium plating. The industry is still agog about the use and possibilities of chromium, but it is still largely in the dark about the patent situation. We have discussed this problem editorially several times and there is no reason for continuing it at length, in this review. All are agreed that chromium is destined to be one of the most important metal coatings. Eventually, the situation will be cleared and the commercial development of chromium will go forward by leaps and bounds. Even now the technical development of chromium is growing with great rapidity. Due to the work of the Bureau of Standards, and the companies engaged in chromium plating for their own use or for licensing to others, the knowledge of the properties and peculiarities of chromium solutions is increasing daily. It is impossible to overestimate the importance of this new field to electroplating in particular and to industry in general.

Another problem which is occupying a prominent place is "spotting out." The Bureau of Standards has set to work with the aid of the research fund contributed by manufacturers and others interested in electro-plating, and the first report on spotting out has been issued. (See THE METAL INDUSTRY, December, 1927, pages 498-499.)

ECONOMIC DEVELOPMENTS

The metal trades grow along with the industries which they serve. During the past year none of these industries has shown any startling expansion, with one conspicuous exception, namely, the airplane industry. The epoch-making flight of Charles A. Lindbergh from New York to Paris was recognized to be the result, not only of his own ability and courage, but also the perfection of design of his plane and the motor which it carried. To those who are acquainted with the details of construction of the plane and motor, their high state of development is in every sense of the word a triumph of modern metallurgy, and in this, non-ferrous metals played a most important part. Metals have a new field for expansion in aircraft. Obviously, aluminum is best fitted, by reason of its light weight, to get the major share of the rewards, but brass, bronze, copper and other metals and alloys will continue to be used in increasing quantities.

Building is being watched perhaps more closely than any other activity. For several years predictions have been made that new building would fall off rapidly, and as regularly as these predictions were made they failed to come true. The year 1927, however, showed a drop of 6 per cent from 1926. According to the Architectural Forum, a leading authority in this field, building should continue in 1928, at least in the same volume, if not reaching greater totals than 1927.

The automobile industry suffered a marked decline with the exception of a few conspicuous companies. General Motors had the largest year in its history. The Ford Motor Company had one of the smallest in the last decade, due to the reorganization necessary in bringing out a new model. The rest of the industry was decidedly spotty with more bad spots than good ones, but the feeling in the motor trades seems to be that 1928 will be one of its biggest years. The metal trades certainly hope so.

The formation of The Copper Institute is undoubtedly one of the most important steps in the stabilization of the market in that metal. Between this Institute and Copper Exporters, a reasonable balance should be maintained between production, stocks on hand and consumption.

One notable feature of 1927 was the large number of consolidations in the metal industries. Almost every month a number of mergers or outright purchases occurred, of companies in the same lines. It is the general belief that these mergers were dictated by the unusually sharp competition and the narrow margins which made it advisable to hang together rather than to hang separately. This reason, of course, may not have obtained in every case, but in general, times like these induce consolidation for protection.

The Anaconda Company continued its program of expansion by purchasing the Detroit Copper and Brass Rolling Mills for operation by the American Brass Company. The Balbach Smelting and Refining Company, one of the oldest secondary smelters in the United States, leased its plant to the American Metal Company for five years. Everdur metal, a new copper alloy developed by the Dupont Company was sold to the American Brass Company. The Chase Companies bought the U. T. Hungerford Brass and Copper Company.

NECROLOGY

Among the men of prominence in the metal industry who passed away during 1927, were the following:

Samuel B. Harper, secretary, American Silver Company, Bristol, Conn.

Arthur W. Pearce, treasurer, Williams Harvey Corporation, New York.

George M. Landers, formerly vice-president, Landers, Frary and Clark, New Britain, Conn.

Shiras Morris, president, Hart and Hegeman Manufacturing Company, Hartford, Conn.

William H. Roberts, president, Roberts Brass Manufacturing Company, Detroit, Mich.

Henry B. Sargent, president, Sargent and Company, New Haven, Conn.

E. Reed Burns, president E. Reed Burns Manufacturing Company, Brooklyn, N. Y.

Francis J. Clamer, formerly president, Ajax Metal Company, Philadelphia, Pa.

Charles H. McKenna, McKenna Brass and Manufacturing Company, Pittsburgh, Pa.

A. L. D. Buxton, president, Perry Buxton Doane Company, Boston, Mass.

Henry E. Russell, formerly president Russell and Erwin Manufacturing Company, New Britain, Conn.

Benjamin A. Hawley, vice-president, American Hardware Corporation, New Britain, Conn.

General Guy E. Tripp, chairman of the Board of Directors, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa.

John T. Pratt, chairman of the Board of Directors, Chromium Corporation of America, New York.

Frederick J. Kingsbury, chairman of the Board of Directors, Bridgeport Brass Company, Bridgeport, Conn.

Edward A. Wells, general manager, A. H. Wells and Company, Inc., Waterbury, Conn.

C. A. Grasselli, chairman of the Board of Directors, Grasselli Chemical Company, Cleveland, Ohio.

John T. Kelly, president, Kelly and Jones Company, Greensburg, Pa.

John B. Kennedy, president, English and Mersick Company, New Haven, Conn.

Norris B. Gregg, vice-president, National Lead Co., N. Y.

D. H. Roberts, founder of the Roberts Brass Company, Detroit, Mich.

Harry L. Brown, secretary, Ohio Brass Co., Mansfield, O.

John F. Wade, works manager, Bristol Brass Corporation, Bristol, Conn.

Henry F. Bassett, president, Taunton-New Bedford Copper Company, Taunton, Mass.

Harris Whittemore, director, Landers, Frary and Clark, New Britain, Conn.

John M. Jones, president, Baltimore Tube Company, Baltimore, Md.

OUTLOOK FOR 1928

Predictions for 1928 are consistently optimistic. The worst of them seem to be that 1928 will show no less activity than 1927. The financial structure of the country is altogether sound. Industrial capacity is still somewhat larger than the demands of consumption, but the falling prices and the stability of wages and purchasing power make for increased consumption. So long as purchasing power remains there will be a demand for manufactures.

So far as the metal industries are concerned, their chief purchasers, electrical manufactures, automobiles, and the building trades, look forward to a good year. Agriculture has not yet fully come back to its own, but it is improving. The railroads have been very prosperous and there seems to be no reason to fear a serious decline.

An excellent summary was given by A. W. Krech, a prominent banker, listing his reasons for optimism.

1. The substantial increase in the value of farm products over that of 1926.
2. Greater efficiency in transportation, with greater economy in operation.
3. The increasing purchasing capacity of a day's labor.
4. The progressive elimination of poverty and want largely by the sane co-operation of capital and labor.
5. General tendency toward lower money rates.

The coming year should be good unless the old bugaboo of the presidential election interferes seriously. Any startling development might throw it in either direction, making it very poor or excellent as the case might be. The chances are, however, that it will be simply good; only reasonably good perhaps, but good.

THE METAL INDUSTRY enters its twenty-sixth year and celebrates its twenty-fifth birthday by taking over THE BRASS WORLD, a kindred publication.

The Staff of The Metal Industry

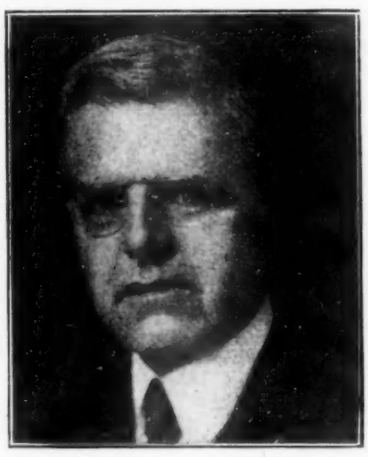
PALMER H. LANGDON
Founder, Editor and Publisher

ERWIN S. SPERRY
Founder and Editor, 1903-1904

ADOLPH BREGMAN
Managing Editor

THOMAS A. TRUMBOUR
Business Manager

EVAN J. ROBINSON
Advertising Manager



GEORGE W. COOPER
Advertising Manager, 1908-24

JESSE L. JONES
Metallurgical Editor

WILLIAM J. REARDON
Foundry Editor

CHARLES H. PROCTOR
Plating-Chemical Editor

Our Twenty-fifth Anniversary

In celebrating the twenty-fifth year since the founding of THE METAL INDUSTRY, we thank our readers and advertisers for their co-operation all of these years. This co-operation has made THE METAL INDUSTRY what it is today, and we wish our patrons a prosperous New Year.

It has been the endeavor of THE METAL INDUSTRY to be a representative publication of all of the branches known in metal fabrication, beginning with the ingot and ending with the finished product. Our publication has aimed to present the latest and best practice in every step of metal manufacture.

To accomplish that endeavor we have sought in all of the industrial countries of the world, the best practical exponents of their respective branches of the metallurgical arts. These authors have put before our readers the best possible shop practice of their day.

Our next effort has been directed to solving the problems of our industry, as they crop up from time to time in all factories, no matter how well managed. In this connection our experts have answered, in our shop problem department, over 3,700 questions, and many more questions and answers have been published in the main reading pages. In addition we have answered hundreds of inquiries directly by mail. We believe that the shop practice of the industry has advanced appreciably since the establishment of this shop problem department and that our expert associate editors who have undertaken to enlighten their fellow craftsmen, have rendered an outstanding service to their industrial fraternity.

Our other departments, which were started and carried on as fast as the growth of the paper would permit, have been records of vital phases of industrial life, in our fields. As our unswerving aim is to issue a publication complete in every respect, this policy will be continued in the future, and we are confident that it will meet the same approval as such management has met in the past.

Likewise in our advertising pages we have attempted to have every branch of manufacture represented, which would bring our advertisers a return, all advertising being refused which was not suitable for the publication. Particular pains have been taken to classify all advertisements that they may be readily found, and not to mix them up with reading matter or to intersperse them with indices and other distractions from the real object of advertising, which is to put before a manufacturer what he needs with the least possible time taken in searching for what he wants.

Needless to say, this advertising policy will be followed in the future.

THE METAL INDUSTRY was founded in January, 1903, by Palmer H. Langdon and the late Erwin S. Sperry, to establish a technical and business publication which would relate to all of the metals except iron, and which are classed as belonging to the non-ferrous group. The principal metals and alloys covered are brass, bronze, copper, tin, lead, zinc, aluminum, nickel, silver and gold.

Our survey of the industry and production figures which are published in this issue indicate the vast extent of metal manufacturing, which is fairly close in size to the iron and steel industry. Production value figures for pig iron in 1926, were about $750,000,000, and for metals, about $600,000,000.

Our effort in the future will be as it has been in the past: to put before the workshops of this great industry, the best technical and business practice that is obtainable.

We herewith present the portraits and careers of the founders, staff and associate editors, and managers of THE METAL INDUSTRY.

PALMER H. LANGDON

Palmer H. Langdon, Founder, Editor and Publisher from 1903 to date, was born November 1st, 1868, in Jersey City, N. J., from where he moved to Buffalo, N. Y., when a child. He attended and graduated from Public School No. 14. At the age of 17 he left Buffalo and went to Providence, R. I., starting in the brass room of the Rhode Island Locomotive Works, as an apprentice, receiving 6 cents per hour, 10 hours a day. From the Rhode Island Locomotive Works he worked in the machine shops of the Grant Locomotive Works of Paterson, N. J., and the Hinkley Locomotive Works of Boston, Mass., both of these plants closing down while he was there. He then entered the electrical factory of Frederick M. Kimball, Boston, Mass., where he remained for several years, when this plant ceased operations. During his apprenticeship and machinist days, he attended the evening classes of the Massachusetts Institute of Technology, and the Young Men's Christian Union of Boston. In 1900, as a resident of New York, he took a course at the first summer school of Columbia University. In 1892 he came to New York getting into the newspaper business as a reporter on several New York dailies and then became correspondent of a Chicago paper. In October, 1894, he was associated with Frederick F. Burgin, who founded the Aluminum World. Afterwards Mr. Langdon became editor and publisher. With the merging of the Aluminum World into THE METAL INDUSTRY in January, 1903, he became publisher, and in June, 1906, both editor and publisher. He has also been president and treasurer of The Metal Industry Publishing Company since its foundation.

ERWIN S. SPERRY

Erwin S. Sperry, Founder and first Editor, 1903-1904, was born in Ansonia, Conn., in 1866. He graduated from the Sheffield Scientific School of Yale University in 1887 and accepted an offer which was immediately made to him, of assistant instructor in chemistry. Mr. Sperry later engaged in industrial work as a chemist and metallurgist, making a reputation for himself throughout the metal industries. He was connected with the Aluminum, Brass & Bronze Company and afterwards superintendent of the Waldo Foundry, both of Bridge-

port, Conn. He later engaged in work as a consulting chemist and metallurgist.

Mr. Sperry was an early contributor to the Aluminum World, the predecessor of THE METAL INDUSTRY, and was editor of THE METAL INDUSTRY from January 1903 to October 1904. In January 1905 he established The Brass World which he edited and published until his death, January 31, 1914.

S. D. V. BURR

S. D. V. Burr, Managing Editor, 1906-1908, was a graduate of Rutgers College in civil engineering. He subsequently received the degrees of A. B. and A. M. Mr. Burr was deeply interested in scientific literature and was connected with a number of engineering and scientific journals. He was the author of a number of engineering books. He died in October, 1908.

LOUIS J. KROM

Louis J. Krom, Managing Editor, 1908-1919, is a graduate of Lehigh University in chemistry and metallurgy. He spent four years with Randolph and Clowes of Waterbury, Conn., and six years with the Chase Rolling Mills of the same city. In 1908 Mr. Krom became assistant editor of THE METAL INDUSTRY and later managing editor. In 1919 he resigned to become works manager of the West Virginia Metal Products Company in Fairmont, W. Va. In 1922 he severed his connection with this company and took up consulting work. He later went with the Chili Exploration Company, at their New York office with whom he remained for about two years. At the present time he is a consulting engineer.

ADOLPH BREGMAN

Adolph Bregman, Managing Editor, 1919 to date, is a graduate of the Colorado School of Mines in 1914. He specialized in metallurgy and for several years after graduation was engaged in smelting and refining operations in an engineering capacity with the Wanakah Mining Company, the Columbia Smelting and Refining Company, and the Nichols Copper Company. He spent over a year in the army during the world war. In 1919 came to THE METAL INDUSTRY as managing editor.

THOMAS A. TRUMBOUR

Thomas A. Trumbour, Business Manager, 1901 to date, was born on May 18, 1883, in Butler, N. J. He attended a local school, and MacChesney's business college in Paterson, N. J. In September 1901 he took a position with The Aluminum World, the predecessor of THE METAL INDUSTRY. He has been with THE METAL INDUSTRY since 1903, rising through various posts to his present position of business manager and secretary of The Metal Industry Publishing Company.

GEORGE W. COOPER

George W. Cooper, Advertising Manager, 1908-1924, was born February 13, 1875, in London, Ont., Canada. After leaving school worked in a newspaper office. He then took up bridge engineering and went into bridge department of the Carnegie Steel Company at Pittsburgh, Pa. His next work was as a sales agent in New York for a concrete mixer, and upon meeting the late Frank B. Gilbreth, contracting engineer, went with him as his publicity manager. In 1908 Mr. Cooper came with THE METAL INDUSTRY and was there 16 years as advertising manager. He resigned to become the publisher of The Glass Industry, which has offices at 50 Church Street, New York.

EVAN J. ROBINSON

Evan J. Robinson, Advertising Manager, 1925 to date, was born in Paterson, N. J., January 10, 1893. He had a grammar school and business college education graduating from MacChesney's. From 1907 to 1914 he was engaged in general industrial work and in 1915 he entered the Lackawanna Railroad offices in New York as a stenographer. From 1917 to 1920 he was a statistician in the United States Railroad Administration and New York Central Railroads. From 1920 to 1925, Mr. Robinson held the post of assistant advertising manager of THE METAL INDUSTRY. In 1925 he was appointed advertising manager and he still occupies that position.

JESSE L. JONES

Jesse L. Jones, Metallurgical Editor, received his technical education at the Ohio State University, Columbus, Ohio, graduating in 1890. His first position was that of assistant chemist with the State Chemist of Ohio. He afterward did chemical work with several steel companies and in 1893 he went with William Cramp and Sons Ship and Engine Building Company, of Philadelphia, Pa., to organize the chemical and physical laboratory of that company. He assisted in introducing into the United States, Parson's manganese bronze and white brass. In 1903 Mr. Jones became metallurgist for the Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa., having in his charge the chemical and physical testing laboratories. He is still connected with the Westinghouse company and his work in metals and alloys has made him one of the foremost metallurgists of the United States. He is a member of numerous technical societies and a past president of several. He is very active in work on technical committees of the American Foundrymen's Association and the American Society for Testing Material.

WILLIAM J. REARDON

William J. Reardon, Foundry Editor, who has a record of over forty years in the brass foundry industry, was born in 1870 in Paterson, N. J. At the age of 15 he began work with McNab and Harlin, serving an apprenticeship of three years as a core-maker and molder. Since that time Mr. Reardon has been engaged in the operation of brass foundries, as foreman and superintendent, for a number of the largest companies in the United States, listing among his employers, the Yale and Towne Manufacturing Company, Westinghouse Electric and Manufacturing Company, Rome Brass and Copper Company, Aluminum Castings Company and others. In 1921 Mr. Reardon organized the National Alloys Company of Detroit, Mich., of which he is now president. The business of this company is the production of metal castings of all kinds, specializing in difficult work, such as pure copper, aluminum bronze and acid resisting alloys.

CHARLES H. PROCTOR

Charles H. Proctor, Plating-Chemical Editor, was born in Birmingham, England, in 1866. At the age of 12 he entered industrial work. He spent some time in

Belgium, leaving there to come to the United States in 1881. Mr. Proctor has worked for a number of the most important manufacturing companies in the United States as foreman plater and in charge of their various plating and finishing operations. Along with his work Mr. Proctor studied chemistry in this field, gaining a theoretical and practical knowledge of finishing processes which has made him one of the foremost electro-platers of the United States. In 1912 he joined the Roessler and Hasslacher Chemical Company as electro-plating expert and has remained with them up to the present time. Mr. Proctor is known as the Founder of the American Electro-Platers' Society which he organized in 1909. He is internationally known wherever there are electro-plating and manufacturing plants through his numerous articles and papers on these subjects.

WILLIAM J. PETTIS

William J. Pettis, Rolling Mill Editor, began his brass manufacturing career with the Randolph and Clowes Company with whom he spent twenty years, rising to the position of superintendent. In 1915 he installed and put into operation a brass rolling mill at Lisbon, Ohio, for the National Brass and Copper Company. He spent some time with the Electric Furnace Company of Alliance, Ohio, and also with the West Virginia Metal Products Company. At the present time he holds an executive position with the National Brass & Copper Company, of Lisbon, O.

WALTER L. ABATE

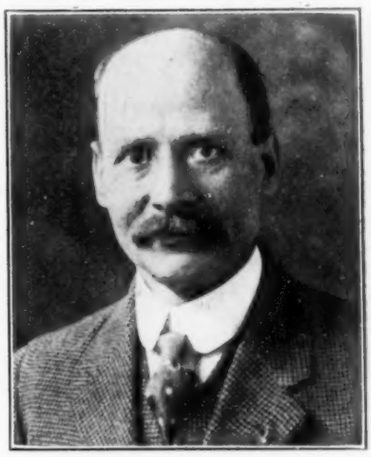
Walter L. Abate, Brass Finishing Editor, was born in Detroit, Mich., in 1867. After graduating from a public school, he served a four-year apprenticeship with James Flower and Brothers, manufacturers of valves and plumbing materials. Mr. Abate grew up in Detroit and had a number of interesting experiences with the automobile industry in its early days. He has been foreman, superintendent and works manager of a number of large organizations, such as McCrae and Roberts Company, Nathan Manufacturing Company and the Standard Sanitary Manufacturing Company. Mr. Abate is now operating an independent brass machine and finishing shop in Detroit, Mich.

PETER W. BLAIR

Peter W. Blair, Mechanical Editor, was born in Perth, Scotland and began his career as a brass finisher's apprentice at the age of 14. After finishing his apprenticeship and continuing his employment as a brass finisher for a few years, he came to the United States. Mr. Blair spent a number of years as foreman of the brass finishing department of the Mueller Manufacturing Company, in Decatur, Ill., and in Sarnia, Ont., Canada. He has also done similar work for the Crane Company, valve manufacturers; the Jenkins Company in similar lines, and is at the present time with the Port Hope Sanitary Manufacturing Company, Port Hope, Ontario, Can.

WILLIAM J. PETTIS
Rolling Mill Editor

WALTER L. ABATE
Brass Finishing Editor



PETER W. BLAIR
Mechanical Editor

Announcement

The Metal Industry Publishing Company has bought the rights, title and good will of the publication known as The Brass World and Platers' Guide, formerly published at 153 Waverly Place, New York. The office of The Brass World has been moved to 11 Cliff Street, New York, where the paper will be issued regularly, the latter part of each month.

The Brass World is the fourth publication taken over by The Metal Industry Publishing Company, the others being The Aluminum World, Copper and Brass, The Brass Founder and Finisher and Electro-Platers Review, all of which have been incorporated in THE METAL INDUSTRY. As stated above, The Brass World will continue as a separate publication.

The Brass World and Platers' Guide was established in January, 1905, at Bridgeport, Conn., by the late Erwin S. Sperry. Upon his death on January 31, 1914, the paper was issued for a year in Bridgeport, by the Sperry estate.

On March 6, 1915, the stock of The Brass World Publishing Company and the publication were acquired by G. A. Tanner and C. N. Manfred, trade journal publishers, who brought the paper to New York. On January 6, 1921, G. A. Tanner became the sole owner. Mr. Tanner has now retired from the publication business.

The former standard of merit of The Brass World will be maintained and improved by the new owners, and application has been made for membership in the Audit Bureau of Circulations.

SHOP PROBLEMS

THIS DEPARTMENT WE ANSWER QUESTIONS RELATING TO SHOP PRACTICE

ASSOCIATE EDITORS { JESSE L. JONES, Metallurgical; WILLIAM J. PETTIS, Rolling Mill; W. J. REARDON, Foundry; W. L. ABATE, Brass Finishing; CHARLES H. PROCTOR, Plating Chemical; P. W. BLAIR, Mechanical

ACID BRASS AND BRONZE

Q.—Will you kindly give us information on acid bronze plating; also acid brass plating.

A.—The only strictly acid electro-plating solutions in commercial use are those of copper and zinc. Brass cannot be plated from an acid solution. Bronze has been plated from an oxalate solution. Considerable work was done by Curry in 1906, and reports of his work on electro deposition of bronze can be found in the Transactions of the American Electrochemical Society for 1906. Mr. Curry's papers on the subject were presented at the annual meeting at Ithaca, N. Y., May 2, 1906.

The solution advocated by him as giving the best results is essentially as follows:

Water	1 gallon
Ammonium oxalate	8 ozs.
Oxalic acid	⅔ oz.
Stannous oxalate	½ oz.
Copper sulphate	2 ozs.

The solution should be prepared in the order given. Use ⅓ of the water first at 160° F., in a second third of the water at the same temperature, dissolve the copper sulphate. When all dissolved, mix with the oxalate and stannous oxalate solution. Finally add the balance of the water cold. Operate the solution at normal room temperature. Voltage 2 to 3, or as may be found advantageous. Anodes, 80 copper, 20% tin. Bronze deposits can be very satisfactorily obtained from cyanide solutions prepared from copper cyanide, nickel cyanide and sodium cyanide.—C. H. P. Problem 3,711.

BLACK NICKEL

Q.—Would like to have some information on the use of black nickel plate for commercial products. Would like to know if black nickel products can be plated advantageously by japanning. These parts are not very large and are used on a vacuum cleaner. They are made mostly of sheet steel and sheet brass. These parts do not need any polishing or buffing operations. They come in fairly bright order from the presses. Would like to know if black nickel used with a brass anode would stand buffing on a small buff. Have been experimenting with a black nickel solution by Mr. Haas and I find that the zinc in the solution does not function with a nickel anode.

A.—Black nickel deposits are used commercially to a more or less extent but the deposits do not have the resistance to friction or abrasion as does enameled or black japanned surfaces. With heavy coatings of lacquer the black nickel plated articles might answer your purpose. To produce bright black nickel plated metal surfaces the base metal must be polished bright. There is always an advantage in the results of black nickel plating if the articles are first coated with a thin deposit of white nickel. If Haas' solution does not function properly with a nickel anode, then try some sheet brass anodes with the nickel. As a hardener, the addition of benzoic acid is a good addition agent, especially so in mechanical black nickel plating. You might try from 1/64 oz. upwards per gallon of solution. More intense blacks result from black nickel solutions when a little ammonia copper solution is added to them. For this purpose, dissolve copper carbonate in aqua ammonia 26°; all it will take up, then let the ammonia clear itself so that an intense clear blue solution results. Add 1/16 oz. per gallon of solution or even less at the beginning. Black nickel deposits can be color-buffed with soft buffs and black rouge, such as is used in polishing silver plated articles.—C. H. P. Problem 3,712.

BLACK ON BRASS

Q.—We are writing to ask if you have any formula under the heading of shop practice or anywhere else relative to the staining or turning of brass black. We would like to get a solution if possible that would stain brass black, so that it would be a permanent black and not rub off.

A.—The only really practical solution of a simple nature that you can use is as follows:

Water	1 quart
Copper carbonate	12 ozs.
Ammonia 26°	3 quarts
Soda ash 58%	2 ozs.

To prepare the solution, dissolve the copper carbonate in the ammonia, the soda ash in the water, heated to 180° F., then mix thoroughly. Immerse the clean and bright brass articles in the dip, heated to 140° F. for a few minutes until black, then remove, wash and dry carefully. To protect the black surface, it should be lacquered. Other methods for black upon brass are by the aid of black nickel electro deposits. For formula, see "Platers' Wrinkles," page 20. The black nickel solution on page 20, given by Haas is an excellent one—C. H. P. Problem 3,713.

BRIGHTER DIP FOR COPPER

Q.—How can I make a bright dip for copper plate?

A.—1. Cleanse the articles in a regular hot alkaline solution. Then wash in cold water.

2. If the copper has any fire scale on its surface, then pickle in a solution as follows:

Water	1 gallon
Sulphuric acid	12 ozs.
Common salt	2 ozs.

Temperature 120-140 deg. F.

As soon as the fire scale is removed by the pickling operation, rewash in water, drain well.

3. From the pickling operation immerse the copper articles in an acid dip consisting of nitric acid—quantity necessary; water, none. Immerse the articles in the dip for a moment; wash in water; drain well, then immerse in alkaline cleaner for a moment, then remove, drain well but do not re-wash in water.

4. Prepare a bright acid dip as follows: nitric acid 38°, 1 gallon; sulphuric acid 66°, 1 gallon; water, 1 pint; muriatic acid, 2 ozs. Mix in the order given, then let the dip cool down to normal temperature, 60 or 70 deg. F. Keep the receptacle surrounded with cold running water. Acid dips give the best results when maintained cool. From 2 and 3 operations, immerse the copper articles in bright dip No. 4 for a moment; make 1 or 2 dips. Rewash in cold water; immerse in a cold soap dip, 1 oz. of neutral soap chips per gallon of water for a moment, then rinse in boiling water and dry out in maplewood sawdust.—C. H. P. Problem 3,714.

CHROMIUM SOLUTION

Q.—Kindly advise the best means of plating brass plumbing supplies with chromium, the best solution to use, anodes, and any other information needed to get good results.

A.—One of the latest chromium solutions is as follows:

Water	1 gallon
Chromic acid	30 to 60 ozs.
Chromate of iron	1 to 2 ozs.
Ammonium oxalate	1 to 2 ozs.

Temperature 110 to 120 deg. F., voltage, maximum 10; minimum 6 volts. High voltage should be used first. Method of preparing solution: ⅓ water, heated to the boiling point, dissolve the chromic acid and chromate of iron. When all dissolved add the balance of the water cold, then add the ammonium oxalate slowly with stirring. The solution is ready for use, but it is best to electrolyze for a short time.

Anodes should be of chrome steel, 18% with some lead anodes.

basis chrome steel 80, lead 20% of the surface area, or lead and steel in similar proportions. The solution should be maintained constant with chromic acid, small amounts of iron and ammonium oxalate.

We would suggest also that you get in touch with the chromium plating companies who have patented processes in order to decide whether to take up their methods or work by yourself.—C. H. P. Problem 3,715.

GOLD ON RUBBER

Q.—Please give me directions for plating a heavy gold on hard vulcanized rubber. The plate should adhere to the rubber, so that it cannot be peeled off easily if a sharp instrument is inserted under it.

A.—Gold plating of hard vulcanized rubber should be done by first coating the rubber with a thin coat of rubber cement. Before the cement dries either finely powdered metallic silver or tin should be applied to the cement and rubbed thoroughly into the surface by brushing. When the coating is hard and dry it may then be silver-plated first to obtain an adhesive deposit, then finally gold plated, preferably in a normal temperature solution with sodium and gold cyanide. A second method would be to coat the rubber with an alcoholic solution of silver nitrate and water. The silver nitrate should first be dissolved in water and then add 2 parts alcohol to 1 part silver nitrate solution. When partly dry, expose the articles to hydrogen sulphide under a glass dome. This may be done by placing pyrites in a dish, then cover over with a 10% solution of sulphuric acid and water. The cover should be quite air-tight. The silver nitrate will be reduced to silver sulphide and is then a good metallic conductor that can be readily plated, first lightly in an acid copper solution then finally in silver and gold solutions. Either of these methods should result in very adhesive deposits of gold upon the surface of rubber.—C. H. P. Problem 3,716.

PLATING AND STRIPPING GOLD

Q.—Would you kindly send us a formula for a good stripping solution for yellow and green gold? That is, I mean, a stripping solution to take the fire coat off and bring up the metal bright. Also a dark green antique plating solution. I mean that composed of a green rose finish and arsenic, or what other chemicals are used in connection with this finish.

A.—We suggest that you try out either of the following electro-strips for yellow and green gold jewelry, to remove the fire coat.

No. 1.	Water	1 gallon
	Sodium cyanide 96-98%	10 ozs.
	Carbonate of potash	4 ozs.
	Bisulphite of soda	1 oz.

Temperature, 180° F. Voltage, 6 to 10. Articles as anode, which should be agitated while stripping. Cathode, sheet lead or carbon.

No. 2.	Water	1 gallon
	Sodium cyanide 96-98%	8 ozs.
	Rochelle salts	2 ozs.
	Phosphate of ammonia	1 oz.

Operate same as above.

Dark antique green finishes are best prepared from green gold solutions, prepared primarily from sodium cyanide, gold chloride and a little silver chloride. The smut is prepared by dissolving 8 ozs. caustic potash in cold water, then heat to 180° F. Add equal proportions of white arsenic and lead acetate mixed together, to the solution all it will dissolve, possibly 1 oz. or more. Use the solution so prepared as a stock solution, add about ¼-oz. liquid measure per gallon of green gold solution or as much as may be required to produce the smut or antique rose desired. Afterwards wash in cold and boiling hot waters, and relieve the smut from the high lights with bicarbonate of soda.—C. H. P. Problem 3,717.

POLISHING KNIVES

Q.—I would like some information on the polishing of steel knives; also auto bumpers and shells. In polishing the steel after we have cleaned and plated the knives in silver, and the bumpers in nickel, the grease comes out through the plating and I use a caustic soda cleaner. After the steel spots out, little rust spots appear.

A.—Steel knives should be polished with 100 and 150 emery wheels; afterwards brushed down with Tampico wheels and a flour emery paste. These manipulations will give a smooth finish. After polishing, boil out in a solution of caustic potash 8 ozs. per gallon of water and 1 oz. sodium cyanide. Brush down with a Tampico wheel and with pumice stone, hydrated lime and water mixed to a paste. After cleansing as outlined, acid dip in a mixture of equal parts muriatic acid and water, used cold. Wash in water and dip in a strong cyanide solution; drain well; wash quickly and plate direct either in the silver solution using a strike solution first, or in nickel solution followed by a silver strike and then regular silver deposit.

Auto bumpers should be polished and cleansed the same way. It may be necessary to rough out with 80 emery instead of 100. Bumpers for the maximum results should first be nickel plated in a hot nickel solution for 5 minutes or more, then washed thoroughly, next copper plated in a hot cyanide of copper solution. Buff to a lustre, re-cleanse, nickel plate, and finally buff to a lustre. These methods as outlined are used by auto bumper manufacturers as well as automobile manufacturers in nickel plating radiator shells, etc.—C. H. P. Problem 3,718.

SATIN FINISH

Q.—Kindly advise how I can get a satin finish like sample, after being through bright dip; also advise me what lacquer I should use.

A.—One sample has not been dipped; the other sample, that we have marked, has been bright acid dipped and dip lacquered. To produce this finish proceed as follows: Cleanse the brass parts from grease, etc., by usual potash cleaners. After cleansing, wash thoroughly in cold water. Immerse for a moment or two in nitric acid dip. Add no water. Drain well, wash in water and immerse in the potash cleaner for a moment, drain well but do not wash in cold water. Immerse in the bright acid dip, prepared as follows:

Nitric acid 38°	1 gallon
Sulphuric acid 66°	1 gallon
Cold water	1 pint
Muriatic acid	1 oz.

Mix the dip the day before using in the order given. Let it cool down to normal temperature and keep the container surrounded by cold running water. After bright acid dipping the brass articles, wash thoroughly in cold water then in boiling water, containing a little soap chips. Dry out in maple sawdust, and finally dip lacquer. Use an iron wire mesh basket. Dry out by the aid of heat. You can purchase dip lacquers from any lacquer firm advertising in THE METAL INDUSTRY.—C. H. P. Problem 3,719.

WHITE GOLD STRIP

Q.—Will you kindly give me a formula for a good white gold strip, 18K; also like a good white gold flash for 18K rings?

A.—The following formula has been used for years for electro-stripping articles made of white gold:

Water	1 gallon
Sodium cyanide	8 ozs.
Rochelle salts	2 ozs.
Phosphate of ammonia	1 oz.

Voltage 6 to 8. Temperature 180° F. Use lead as cathode; the articles become the anode. Agitate the articles while stripping.

The following solution also gives good results under similar operating conditions.

Water	1 gallon
Sodium cyanide 96-98°	10 ozs.
Carbonate of potash	4 ozs.
Bisulphite of soda	1 oz.

You can use up to 10 volts with this solution. Silver can be used as the cathode, the articles to be stripped, the anodes.

For flashing white gold articles, there is nothing better than a tin deposit. Electro-deposited tin is white. It brushes easily and does not oxidize. Try the following:

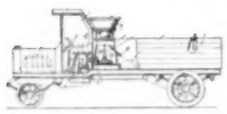
Water	1 gallon
Sodium stannate	6 ozs.
Caustic potash	½ oz.
Cresylic acid	½ oz.

Temperature of solution, 160-180° F. Voltage 3 to 4. Anodes, pure tin or insoluble anodes of sheet steel.—C. H. P. Problem 3,720.

PATENTS

A REVIEW OF CURRENT PATENTS OF INTEREST

1,647,371. November 1, 1927. **Apparatus for Regenerating Bulky Waste Metal.** Richard Philipp, Eisenach, Germany, assignor to the Firm Magnet-Werk G. m. b. H. Eisenach Spezialfabrik für Elektromagnet Apparate, Eisenach, Saxe-Weimar, Germany.

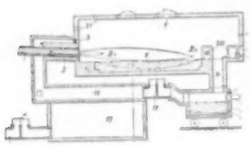


A regenerating and salvaging apparatus comprising a vehicle having a body; and a disintegrating apparatus on said vehicle constructed and positioned to receive bulky containers and reducing and disintegrating them to small volume, and to discharge them into the body.

1,647,381. November 1, 1927. **Process for Making Liquid Zinc from Blue Powder.** Filip Tharaldsen, Oslo, Norway.

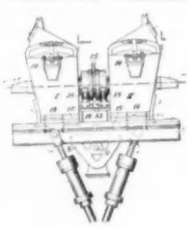
The process of making liquid zinc from blue powder which comprises superimposing a mass of blue powder upon a bath of liquid zinc and raising a portion of the liquid zinc above the powder and pouring it over the latter.

1,647,608. November 1, 1927. **Smelting Furnace.** Friedrich Wilhelm Corsalli, Berlin, Germany.



In combination, a furnace having a main and auxiliary heating portion; flame producing apparatus arranged to direct a flame into said main portion and heat said auxiliary portion; a slag chamber to receive slag and waste flame from said furnace; heat accumulating chambers connected to said slag chamber and heated by said waste therefrom said chamber surrounding a duct for the passage of air therethrough; and means whereby the waste flame is conducted continuously in one direction to said slag chamber to maintain the slag in liquid state.

1,647,787. November 1, 1927. **Electric Induction Furnace.** Jose Ricardo de Zubiria, Bilbao, Spain.



An electric induction furnace comprising a hearth, an opening in the wall of said hearth, a straight tubular channel interchangeably connected to said opening, means adapted to adjust said hearth relatively to and force it against said channel, a transformer core surrounding said channel, and a primary winding on said core.

1,648,262. November 8, 1927. **Process of Treating Aluminum Screenings, etc.** John G. G. Frost, Cleveland, Ohio, assignor to The National Smelting Company, Cleveland, Ohio.

The method of recovering the aluminum and aluminum compounds present in dross screenings and the like which consists in subjecting the screenings to treatment with sulphur dioxide and water, separating the solution from the residue and desulphiting the solution to obtain aluminum hydroxide.

1,648,263. November 8, 1927. **Process of Recovering Aluminum from Aluminum Screenings and the Like.** John G. G. Frost, Cleveland, Ohio, assignor to The National Smelting Company, Cleveland, Ohio.

The method of recovering the aluminum content from dross screenings and the like which comprises, subjecting the screenings to treatment with sulphur dioxide.

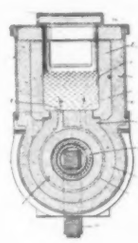
1,648,504. November 8, 1927. **Apparatus for Producing a Silver Coating on Glass.** Luitpold Offenbacher, Furth, Germany, assignor to Bayerische Spiegelglasfabriken Bechmann-Kupfer, Furth in Bavaria, Germany.

An apparatus for silver coating sheets or plates of glass comprising in combination an oval track, a heated drying chamber in the shape of a tunnel on said track, a transportable frame, wheels on said frame, a table on said frame, means for producing a see-saw motion of said table, and means for propelling said transportable frame so that it runs on said track.

1,648,678. November 8, 1927. **Composite Metal Article.** Walther Ehlers, Berlin, Germany, assignor to General Electric Company, a Corporation of New York.

A composite metal body made up of closely compacted spindle-shaped particles of metal.

1,648,707. November 8, 1927. **Induction Furnace.** James M. Weed, Scotia, N. Y., assignor to General Electric Company, a Corporation of New York.



An induction furnace comprising a crucible providing a reservoir for the charge and a looped chamber communicating with said reservoir within which a portion of the charge constitutes a closed secondary, a primary winding for inducting heating current in said secondary, and means for causing said charge to flow in a substantially spiral path through said chamber, the return flow being through said reservoir.

1,648,722. November 8, 1927. **Bearing Material and Method of Making the Same.** Carl Claus, Plainfield, N. J.

The method of making self-lubricating bearing material, which consists in intimately mixing together finely divided copper, tin, zinc and graphite with the copper largely in excess of the other three ingredients taken together, the metals being practically free from oxidation, then compressing from opposing directions the mixture into a relatively hard consolidated body, then placing it in a closed container and heating it from about 1400° to about 1500° F. for a period from about ten to twenty minutes.

1,648,947. November 15, 1927. **Art of Refining Copper.** Ernest H. Jacobs, Chicago, Ill., assignor to Electrical Engineers Equipment Company, Chicago, Ill.

The process of casting copper which comprises melting under a blanket of reducing material such as charcoal, a batch of copper, and adding to the melted copper a conditioning or purifying alloy or flux in approximately the proportion of 9 ounces of said alloy or flux to 200 pounds of copper, said flux being added just prior to pouring the copper, comprising substantially the following constituents, namely, copper 10 pounds, phosphor copper three pounds, copper sulphate one pound, fluorspar one-half pound and borax one-half pound.

1,648,954. November 15, 1927. **Production of Rare Metals and Alloys Thereof.** John Wesley Marden, East Orange, N. J., assignor to Westinghouse Lamp Company, a Corporation of Pennsylvania.

A method of preparing metals which comprises mixing a salt of rare metal with more than the theoretical amount of a metal necessary to completely reduce said salt, heating the same to reaction temperature, treating out the substances thus formed, except the alloy, and heating the alloy thus formed in an inert environment at a sufficiently high temperature to volatilize the second metal.

1,649,521. November 15, 1927. **Magnesium Alloy.** John A. Gann, Midland, Mich., assignor to The Dow Chemical Company, Midland, Mich.

As a new product, an alloy containing not less than eighty nor more than ninety-nine and one-half per cent of magnesium and not more than twenty nor less than one-half of one per cent of nickel, said alloy having a tensile strength in excess of 18,000 pounds per square inch, Brinell hardness approximately 45 and single-blow impact-toughness between 40 and 30.

EQUIPMENT

NEW AND USEFUL DEVICES, MACHINERY AND SUPPLIES OF INTEREST

Physical Properties of Adnic

By WILLIAM B. PRICE*

Chief Metallurgist, Scovill Manufacturing Company, Waterbury, Conn.

Adnic is the trade name for a new corrosion and heat-resisting white metal alloy, having the composition copper, 70 per cent; nickel, 29 per cent; tin, 1 per cent.

The name is an abbreviation from Admiralty nickel, the proportion of copper and tin being the same as in regular Admiralty condenser metal, with 29 per cent of nickel replacing the same percentage of zinc. This alloy was originally developed to meet the demands for a suitable diaphragm material.

The physical properties of ½-in. hard rod, compared with the physical properties of other well-known alloys, such as Ambrac and hard aluminum bronze, are shown in the table below.

PHYSICAL PROPERTIES, HARD ALUMINUM BRONZE

	Tensile Strength, Lb.	Elongation in 10 In., Per Cent
Bronze, 5 per cent	69,000	12
Bronze, 8 per cent	83,000	20
Bronze, 10 per cent	96,000	5

PHYSICAL PROPERTIES OF AMBRAC

½ In. Hard Rod

Modulus of elasticity, lb. per sq. in.	19,000,000
Elastic limit, lb. per sq. in.	75,000
Tensile strength, lb. per sq. in.	80,000
Elongation in 2 in., per cent	12
Electrical resistivity at 20 deg. C., ohms	172
Melting point, deg. C.	1,150
Coefficient of thermal expansion, per deg. C.	0.0000164
Coefficient of thermal expansion, per deg. F.	0.0000091
Density at 20 deg. C. (68 deg. F.), lb. per cu. in.	0.3194

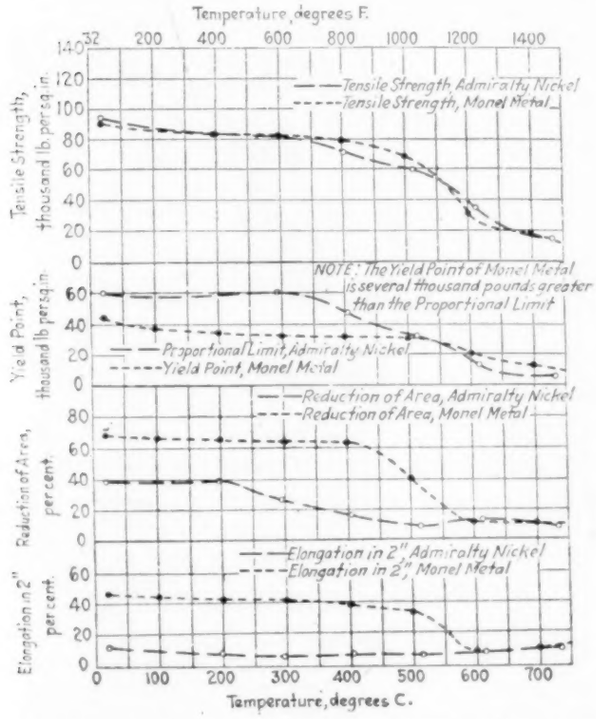


FIG. 1.—PHYSICAL PROPERTIES OF MONEL METAL AND ADMIRALTY NICKEL AT ELEVATED TEMPERATURES

PHYSICAL PROPERTIES OF ADNIC

½ In. Hard Rod

Modulus of elasticity, lb. per sq. in.	21,300,000
Elastic limit, lb. per sq. in.	85,000
Yield point, lb. per sq. in.	107,000
Tensile strength, lb. per sq. in.	113,200
Elongation in 2 in., per cent	10
Reduction in area, per cent	56½
Scleroscopic hardness (U. Hammer)	31
Coefficient of thermal expansion, per deg. C.	0.0000163
Electrical resistivity at 20 deg. C., ohms	256
Melting point, deg. C.	1,205
Density at 20 deg. C. (68 deg. F.), lb. per cu. in.	0.3214

PHYSICAL PROPERTIES OF ADNIC

1 In. Hot Rolled Hex. Rod

Tensile strength, lb. per sq. in.	64,500
Elastic limit, lb. per sq. in.	30,500
Yield-point, lb. per sq. in.	35,600
Reduction in area on ½ in. dia. cross-section, per cent.	72.2
Elongation in 2 in., per cent.	46

TENSILE PROPERTIES OF ADMIRALTY NICKEL BARS AT HIGH TEMPERATURES AS DETERMINED BY THE U. S. BUREAU OF STANDARDS. (0.375 In. No. 4 Hard)

Specimen Number	Temperature of Test °C.	Temperature of Test °F.	Prop. Limit, Lb. per Sq. In.	Ten. Str., Lb. per Sq. In.	Break. Str. Lb. per Sq. In.	Elong. Per Cent in 2 In.	Reduction in Area, Per Cent
AN-2	20	70	60,000	94,000	123,600	12.0	38.7
3	197	387	57,000	85,500	114,000	7.0	38.5
9	197	387	60,000	80,200	105,800	9.0	38.6
Av.	197	387	58,500	82,900	109,900	8.0	38.6
4	296	557	60,000	81,100	96,000	6.0	26.5
5	404	769	47,500	69,800	77,000	8.0	17.5
10	404	769	45,000	71,400	80,500	6.5	15.4
Av.	404	769	46,300	70,600	78,800	7.2	16.4
6	514	957	32,500	62,000	68,200	5.0	9.2
11	514	957	30,000	56,000	62,000	6.0	8.4
Av.	514	957	31,300	59,300	65,100	5.5	8.8
7	613	1,135	12,500	32,800	34,700	8.0	13.7
12	613	1,135	12,500	35,300	39,200	7.5	11.0
Av.	613	1,135	12,500	34,100	37,000	7.7	12.3
8	735	1,355	5,000	14,500	13,700	9.0	9.2

* Calculated on reduced section at fracture.

Fig. 1 shows comparative figures for Admiralty nickel and monel metal, compiled from tests determined by the U. S. Bureau of Standards.

* From Mining and Metallurgy, November, 1927.

In Fig. 2, physical properties as determined in the laboratory of the Scovill Manufacturing Company at elevated temperatures are given. The data derived from such charts are helpful in determining the hot-working range. The best hot-working range for this alloy lies between 850 and 1,100 deg. C.

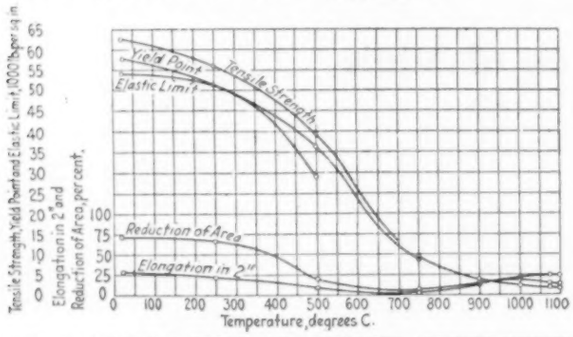

Tensile Strength, Yield Point and Elastic Limit, 1,000 lbs. per sq. in.
Elongation in 2" and Reduction of Area, per cent.
Yield Point
Tensile Strength
Elastic Limit
Reduction of Area
Elongation in 2"
Temperature, degrees C.

FIG. 2. TENSILE TESTS AT ELEVATED TEMPERATURES NO. 511 ADNIC ALLOY

A typical analysis of Adnic which was successfully hot-rolled in sheet and rod form is as follows: Copper, 69.12 per cent; iron, 0.18 per cent; tin, 1.03 per cent; nickel, 28.23 per cent; manganese, 0.94 per cent; sulphur, 0.01 per cent; carbon, 0.059 per cent; zinc (diff.), 0.431 per cent.

There has long been a demand for a white nickel alloy which will resist corrosion, show good strength at elevated temperatures, and not be susceptible to the well-known phenomena of season cracking. This alloy fulfills all these requirements and withstands the action of alkalies, hot gases, salt solutions, dilute organic and inorganic acids, and maintains its strength to a remarkable degree at high temperatures.

Many alloys now used for the purposes mentioned above are refractory, and can only be had in the cast form, but Adnic, on account of its remarkable ductility, can be drawn, stamped, hot-forged, and spun. It can be both hot and cold worked, and can be furnished in the form of sheet, wire, rod and tubes, although at the present time it is only produced in large quantities on a commercial scale in sheet form. When cold-drawn in wire annealed state it has a tensile strength of approximately 77,000 lb. per sq. in., and an elongation of 2 per cent in 2 in. In the annealed state it has a tensile strength of approximately 77,000 lb. per sq. in., and an elongation of about 35 per cent in 2 in.

For comparative purposes the tensile strength of ⅜-in. hot-rolled Everdur rod at elevated temperatures, determined by U. S. Bureau of Standards, is given below.

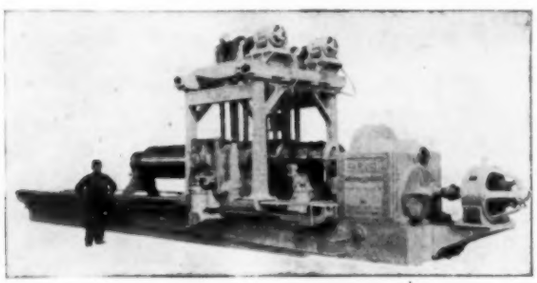
Temp. °F.	Ultimate Lb. per Sq. In.	Elongation in 2 In. Gage Length Per Cent	Reduction of Area Per Cent
80	72,650	43.5	51.0
500	60,200	33.0	67.4
750	35,930	25.5	69.4
1,000	14,480	18.0	71.4

Thermal conductivity, B.t.u. per sq. ft. per hr., 1 in. thickness	72.6
Electrical resistivity, ohms per cir. mil-foot	186
Coefficient of linear expansion, per deg. C.	0.0000170

NEW ROLL GRINDER CROWNING DEVICE

The Farrel Foundry and Machine Company of Ansonia, Conn., has designed a new 36" two-wheel grinder for quick accurate grinding of rolls not over 36" in diameter, that has a new crowning device by means of which a perfect crown is said to be obtained without using any cut and try method.

The carriage is run to the center of the roll, two nuts are loosened and the scale turned to the desired crown. The nuts are then tightened, a clutch thrown in and the crowning operation is started. The action of the crowning device is perfected by means of a cam acting through lifting rods. The back of the wheel head is raised and lowered and the grinding head pivoted in front of



36" FARREL TWO-WHEEL GRINDER SHOWING MAIN 25 HP. DRIVE AND GRINDER DRIVE.

the wheel head. Thus the wheels are moved to and from the center of the roll and produce a perfect crown. Concaving is also accomplished accurately and quickly with this device. If straight grinding is desired the entire device may be disengaged by merely throwing a clutch.

The grinding is performed by two grinding wheels on opposite sides of the roll. They are mounted on the swing rest principle to compensate for any inaccuracies of the ways. Each grinding wheel is 20" in diameter with a 2" face and is driven by a 7½ hp. Westinghouse motor. This provides for quick and economic production, for the wheels can be driven to their maximum capacity.

The entire machine including the driving head, the bed, the ways, and the neck rests, is rigidly and sturdily constructed, and all parts are adequately protected. The driving head which is direct-connected to a Westinghouse 25 hp. motor, is completely enclosed and provided with flood lubrication. Automatic lubrication is also provided for the ways and the feed screw as well as for the head.

NEW SPRAY GUN

The DeVilbiss Company of Toledo, Ohio, is putting on the market a new and greatly improved spray gun, featuring particularly a spray head with graduated adjustment controlling both the character and width of the fan spray, and a type of construction insuring positive self-centering of the nozzle at all times. This provides for the most advantageous application of any paint, varnish or lacquer material on any kind of surface—serving in full measure the industrial finishing room, the automobile repaint shop and the portable painting field.

NEW DEVILBISS SPRAY GUN

Other advantages claimed are as follows:

Quick detachable spray head.

All moving parts enclosed and protected.

Body made of special high strength, heat treated alloy aluminum drop forging—material is as strong as steel and less than half the weight.

Insures perfecty atomized, uniform, soft spray under all conditions, employing suction feed, gravity feed or pressure feed of material, with lowest practicable pressures without "splitting" of spray, "heavy center," or over-spray."

Quick fluid needle adjustment—instantaneous, accurate trigger control.

Positive fluid cut-off at nozzle orifice—no dripping of material from nozzle.

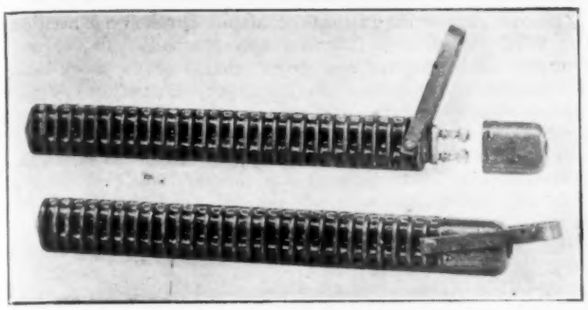
Parts requiring cleaning, all confined to detachable spray head.

NEW POLISHING MACHINE

The Metal Finishers' Machine Company, 4001 West 25th Street, Cleveland, Ohio, has developed, after considerable experimental work, an automatic electrically controlled polishing machine for sheet metal, and also an automatic electrically controlled polishing machine for strips and coils. These machines are now perfected and the company is manufacturing them for the trade.

ELECTRIC MOULD DRYING UNIT

An electric heating unit for drying large sand moulds in brass, steel or iron foundries has been designed by the General Electric Company to obviate the attention required by the usual kerosene lamps, stoves, coke, or coal fires usually employed. Use of the new unit is expected to minimize attention and labor required by other methods in cleaning moulds after drying.



ELECTRIC MOULD DRYER

The electric device consists of a helicoil, sheathwire unit cast into iron. The terminals are protected by a cast-iron cap with an insulated hole in it, through which lead wires may be brought. Asbestos lead wire is recommended for use with the unit to withstand heat.

As the electric unit will operate directly across the line voltage, any number required in a mould may be used. A suitable hook is provided at the terminal end by which the heater may be supported in deep moulds. In shallow moulds where the heater must be laid horizontally, it should be supported on metal blocks to prevent its touching the sand and thus causing the heater to overheat and spoil the mould. It is also recommended that a sheet metal cover be placed over the mould during drying to speed up the process and reduce heat losses.

The new unit is rated 1250 watts at either 110 or 220 volts. It has a shipping weight of approximately 10 pounds and the following dimensions: Overall length, 21 inches; length of heating surface, 18 inches; width, 2¼ inches, and thickness, one inch.

NEW SOLDER SUBSTITUTE

The American Machine & Foundry Company, New York, reports increasing sales of their new alloy "Amaloy" on which they went into production at the opening of the current year. The product, made mainly of pure lead with a small amount of alloy, is said to be proving practical as a substitute for solder in a number of uses as well as for coating purposes on iron and steel products as a means of preventing corrosion. It is now being tried by some can producers and canning companies, and also, by several manufacturers of automobile radiators.

Equipment and Supply Catalogs

Hardinge Unit Coal Pulverizer. Hardinge Company, York, Pa.

Alumalite Visors. S. E. Knowles Company, San Francisco, Cal.

Program in Chemical Engineering. University of Michigan, Ann Arbor, Mich.

Centrifugal Air Compressors. General Electric Company, Schenectady, N. Y.

Weight and Measure. American Institute of Weights and Measures, New York.

MacLeod Process Electric Butt Welding. McLeod Company, Cincinnati, Ohio.

The Concentrated Arc in Welding. General Electric Company, Schenectady, N. Y.

Science Applied to Metal Cleaning. The Cowles Detergent Company, Cleveland, Ohio.

Refrigerant Motors. Electric Machinery Manufacturing Company, Minneapolis, Minn.

Mobile X-Ray Equipment. By Dr. Ancel St. John. Herbert R. Isenburger, Inc., New York.

Oil Burners and Preheaters for Generators. Alexander Milburn Company, Baltimore, Md.

Semi-Automatic Compression Resistance Starters. Allen Bradley Company, Milwaukee, Wis.

A Shake Down of Facts about the Leahy vibrating screen. Deister Concentrator Company, Fort Wayne, Ind.

Recent Applications of the Spectrograph to Metallurgical Analyses. Adam Hilger, Ltd., London, England.

The Design of Furnaces for Pulverized Coal. By Martin Frisch. Combustion Engineering Corporation, New York.

Handling Equipment, such as lift trucks, portable elevators, barrel trucks, hoists, etc. Barrett-Cravens Company, Chicago, Ill.

Tables of the Mechanical Testing of Metals. Deutscher Verband fur die Materialprüfungen der Technik Geschalftstelle, Berlin, Germany.

Better Business Through Research in New England Industry. Policyholders Service Bureau, Metropolitan Life Insurance Company.

Aims and Tendencies in Steam Generation and Combustion Engineering. By Martin Frisch. Combustion Engineering Corporation, New York.

The Borescopes. Portable, optical instruments for the detailed examination of the inside surfaces of long hollow metal parts. Herman A. Holz, New York.

78 Years of Operation. A reproduction of a certificate of honorary degree of Fellowship of the American Institute of the City of New York, issued to W. H. Kemp Company, gold leaf manufacturers, New York.

The Quaker City Platers' Reminder. A pocket folder of technical and American Electro-Platers' Society Information, published by the Philadelphia Branch. It may be obtained from George Gehling, 5001 Edmund Street, Philadelphia.

The A B C of Hydrogen Ion Control. LaMotte Chemical Products Company, Baltimore, Md. This is the 4th edition of this book which includes 124 pages discussing the theory and applications of hydrogen ion control in every branch of research and industrial work. Hydrogen ion control has assumed considerable importance in the plating industry, particularly since the discovery of the effect of hydrogen in nickel solutions.

COMPLIMENTS OF THE SEASON

We have received Christmas and New Year's cards, and calendars from the following friends, whom we wish to thank for their thoughtfulness.

Dr. Robert J. Anderson, Fairmont, W. Va.
J. J. Berliner, New York.
A. L. Haasis, Joseph Dixon Crucible Company, Jersey City, N. J.
Hardinge Company, York, Pa.
Weisberg and Greenwald, New York.
Wisconsin Trade News Bureau, Milwaukee, Wis.
Victor Photo Engraving Company, New York.

CALENDARS

Advance Wheel & Manufacturing Company, Chicago, Ill.
American Exchange Irving Trust Company, New York.
Crown Rheostat and Supply Company, Chicago, Ill.
General Electric Company, Schenectady, N. Y.
International Chemical Company, Philadelphia, Pa.
Jersey Printing Company, Bayonne, N. J.
Charles F. Kenworthy, Inc., Waterbury, Conn.
Magosy and Buscher, New York.
New York Central Lines, New York.
Niagara Falls Smelting and Refining Corporation, Buffalo, N. Y.
Paxson-Taggart, Inc., Philadelphia, Pa.
West Virginia Pulp and Paper Company, New York.

ASSOCIATIONS and SOCIETIES

Reviews of the Accomplishments in 1927 and Plans for 1928

AMERICAN FOUNDRYMEN'S ASSOCIATION

HEADQUARTERS, 140 S. DEARBORN STREET, CHICAGO

The 1927 convention of the American Foundrymen's Association held at Chicago in June, was the first convention of the association in twenty years without an exhibit. Its success as a technical meeting with 1,100 in attendance was greater than any previous meeting and showed the extent to which attention is paid to the technical advancement of the industry. This increase in interest in the technical advancement of the foundry industry has also been recorded by an increase in membership of the A. F. A. which at present is 2,300.

The interests of the non-ferrous industry was represented at the 1927 meeting by a round table meeting on practical brass foundry problems and a regular technical session at which papers on brass foundry refractories, production control and aluminum bronze were presented. The refractories information presented was that acquired by a survey of the industry by a subcommittee of the Joint Foundry Refractories Committee. This brought out the noteworthy fact that the average life of brass furnace linings falls far short of the maximum obtainable, due to lack of adequate records and lack of knowledge on the part of those who install the furnace linings and have charge of their maintenance.

Aluminum bronze was shown to have a very distinct place in engineering construction because of its high strength and working properties.

Following the Detroit meeting symposium on pyrometer control of pouring temperature of non-ferrous castings metals the industry has been assured that accurate temperature control is very necessary in providing proper pouring temperatures which are important from the standpoint of securing the best properties. Further, the industry has been shown that adequate and practical equipment for securing temperature control is available.

The A. F. A. is reorganizing its work in the non-ferrous casting industry to make it of more direct practical value to the brass and aluminum foundryman. At present its non-ferrous committee is concerned largely with cooperating with the similar committee of the American Society for Testing Materials in the developing of specifications for metals for casting purposes.

December 20, 1927. R. E. KENNEDY.

INSTITUTE OF METALS DIVISION

HEADQUARTERS, 29 W. 39 STREET, NEW YORK

The past year of the Institute of Metals Division has been active. The Winter meeting in February was unusually valuable and interesting. The program was strong, thanks to the work done by S. Skowronski, Chairman of the Papers Committee. The Fall meeting was held for the first time in connection with the American Society for Steel Treating in Detroit, in the same building with the meetings of the American Welding Society and the Steel Treaters. Arrangements for the meeting were very well made and everything went off smoothly owing to the splendid cooperation of the New York office of the Division.

The program for 1928 will be carried out in the same manner, namely a Winter meeting in February and a Fall meeting with the American Society for Steel Treating in Philadelphia in September.

The Membership Committee has been active during the year, and there has been a considerable increase in the membership of the Division.

The publication of a separate volume of the papers read before the meetings of the Division entitled "The Proceedings of the Institute of Metals Division for 1927" marked a distinct advance in the publication policy of the American Institute of Mining and Metallurgical Engineers with reference to Division activities. The quality of the papers appearing in this volume is excellent, and it will be a great advantage to have them gathered together in one place and run serially for reference purposes.

The finances of the Division are in good shape, cooperation with the Division by the Institute Treasury has been excellent, and sufficient money has been available to carry on many incidental items such as the revision of mailing lists and sending out special notices, thus keeping the members fully informed of the progress of the work.

A distinct advance in publication policy has been the inclusion of an Institute of Metals Division page in Mining and Metallurgy. This gives a definite place for notes from Division members and has been a pronounced success under the able direction of E. C. Bain of the Union Carbide and Carbon Research laboratories.

December 20, 1927. W. M. CORSE.

THE AMERICAN ELECTRO-PLATERS' SOCIETY

HEADQUARTERS, CARE OF W. S. BARROWS, 628 DOVERCOURT ROAD, TORONTO, CANADA

If heretofore, the electroplaters of the United States have visualized the whole Dominion of Canada as a land of rock and snow, the opportunity to learn the truth will present itself when the annual meeting of the American Electroplaters Society opens in Toronto, Ontario, in June 1928. Convention headquarters will be at King Edward Hotel, where reservations for accommodation should be made now, as the hotels of Toronto will be extremely busy with an unusual tourist and convention trade at the time of the A. E. S. convention. Five educational sessions of exceptional brilliancy will mark this meeting as of unprecedented value to both electroplater and manufacturer of plated products, while the manufacturers catering to the polishing and plating industry will be given a splendid opportunity to display his goods to an international gathering of men directly interested in metal finishing in its various phases. Speakers of prominence are being obtained, and the papers will be of high order, covering practically every subject of present day interest to the metal finisher. Exhibitors will not experience difficulty getting exhibits into Canada.

A souvenir program which will be valued as a volume of reference rather than a waste basket edition is in preparation. One hundred snappy advertisements are wanted for this publication. Have you sent yours in? The official badge will be emblematic of the international unity of purpose responsible for the 17th annual assembly and worthy of mention in your will. Be sure to get one.

The annual banquet which is usually the final feature, will be held on Wednesday evening, June 27th, so as to enable every delegate and visitor to be present.

The closing session will be held Thursday morning, June 28th.

One of the recreational features will be a trip across Lake Ontario by steamer, up the Niagara river to Lewiston, where electric cars will be boarded for a trip through the famous Gorge, passing Whirlpool Rapids and the Whirlpool, the latter sixty acres in extent and two hundred feet deep, and many other spots of lesser fame but of magnificent scenic beauty. Reaching Niagara Falls, N. Y., the delegation will be given ample time to see the city and the Falls from various points on the American side, before crossing to Niagara Falls, Ontario, where the annual base ball game will be played, and the Falls, illuminated, will be viewed to best advantage. Then returning to Queenstown, Ontario, by electric car, passing Brocks Monument, we will board steamer for a moonlight ride to Toronto. The convention committee cordially invites volunteers for presentation of papers, particularly with reference to deposition of chromium, or on the subject Zinc versus Cadmium. Authors of recognized standing in the various branches of the industries employing Gold, Silver or Platinum are respectfully requested to furnish papers.

The committee is anxious to make the 1928 convention a memorable event. You can assist by cooperating now. Make your capabilities known and the benefits will be mutual.

A registration exceeding in numbers any previous A. E. S. annual convention is anticipated. There is a reason.

Begin now to get a "Toronto Party" formed and help make this an educational feast and a recreational event never to be forgotten.

December 26, 1927. W. S. BARROWS,
Secretary Convention Committee.

CHICAGO BRANCH

HEADQUARTERS, CARE OF S. J. C. TRAPP, 1127 N. 7th STREET, MAYWOOD, ILL.

Chicago Branch American Electro-Platers' Society will hold its annual banquet, Saturday, January 21st, 1928, at the Palmer House Hotel.

H. A. Gilbertson, chairman of the Banquet Committee, reports that this will be the best Banquet ever given by Chicago Branch. An educational session will be held in the afternoon, beginning at 2.30 sharp.

O. E. Servis, chairman of the educational committee, reports that he has papers from Dr. O. P. Watts, Charles H. Proctor, C. Nixon, F. Greenwald, and G. Masnerow, with several other papers to come.

Tickets will be $4.00 per person. Ladies of course will be welcome. Dancing will follow the banquet.

NEW YORK BRANCH

HEADQUARTERS, CARE OF R. J. LIGUORI, 127 VANDERBILT AVENUE, BROOKLYN, N. Y.

The two meetings of New York Branch in November were very interesting. Librarian E. Schor is back after a successful operation.

The branch had the honor of having Charles Proctor with them at their first meeting on November 11, 1927.

The Banquet Committee is made up of: Chairman, Phillip Morningstar, 16 Golder Avenue, Jamaica, N. Y.; Secretary, Ralph Liquori, 127 Vanderbilt Avenue, Brooklyn, N. Y.; Booklet Committee, Chairman, Arthur Grinham, 1147 Broadway, N. Y.

This is the 19th annual banquet and will be held at the Aldine Club, 200 Fifth Avenue, N. Y. C., Feb. 19, 1928.

The New York Branch especially requests all those who expect to attend this banquet to make their reservations with payment for same as early as possible. These reservations must be in by February 11, 1928. Attendance will be limited to 500 to avoid overcrowding. No tickets will be sold at the door.

INTERNATIONAL FELLOWSHIP CLUB

HEADQUARTERS, CARE OF FRANK J. CLARK, 43 FORT PLEASANT AVENUE, SPRINGFIELD, MASS.

The International Fellowship Club was founded a few years ago to promote better relations in the electro-plating supply industry between the salesman and purchasing agents.

How well this organization has developed has been indicated by the increased attendance at its annual meetings held in connection with the annual conventions of the American Electro-Platers Society, as well as semi-annual meetings in New York and Chicago.

We have recently voted on and approved a new code of ethics that have to do with the relations between the seller and the buyer. These ethics will be favorably commented on by the Department of Commerce which is always pleased to hear of work of this nature, and will raise the standard of the relations of the salesmen and all those with whom he comes in contact in connection with the merchandizing of better products in the metal industries.

We expect at our next meeting that will be held jointly with the Annual Educational Session and Banquet of the Chicago Branch of the American Electro-Platers Society, on Saturday, January 21, 1928, at the Harrison Hotel, to have a speaker of prominence.

The coming year will greatly increase the membership in our International Good Fellowship Club and to all men connected with our industry we offer a cordial invitation to join our club. We shall be glad to show them the cordial hospitality that the members of this club are familiar with.

DECEMBER 17, 1927 FRANK J. CLARK.

EQUIPMENT AND SUPPLY ASSOCIATION

HEADQUARTERS, CARE OF S. E. HUENERFAUTH, 1910 MAYPOLE AVENUE, CHICAGO, ILL.

The Metal Finishers' Equipment and Supply Association has made fair progress this year. They have only held two meetings and are getting well organized. Real developments should be forthcoming soon.

December 12, 1927. S. E. HUENERFAUTH.

WASTE MATERIAL DEALERS

HEADQUARTERS, TIMES BUILDING, NEW YORK

Men at the head of Salvage Departments of some of the largest industrial organizations in the United States met in conference in December 1927 at the headquarters of the National Association of Waste Material Dealers, Inc., in New York, for an all-day discussion of the many problems that such men have to deal with.

R. W. Phillips of E. I. duPont deNemours & Company, who has been a member of the Board of Directors of the Association for some years, presided throughout the conference. The program was exceedingly interesting and included the following events:

Brief Statement as to purpose of Conference—Charles M. Haskins, Secretary.

Ten Minute Talks:

57 Varieties of Salvage—R. W. Phillips of E. I. duPont deNemours & Company.

Salvaging Problems Where Plants are Scattered—G. H. Bangs, of Western Electric Company.

Growth and Importance of Salvage Operations of American Railroads—A. L. Prentice, representing Purchases and Stores Division of American Railway Association.

Should Large Industrial Corporations Sell Only on Sealed Bids Opened in the Presence of Buyers?—C. H. McKnight, of General Electric Company.

Salvage Material in the Automobile Industry—J. H. Tonge, of Hudson Motor Car Company.

Question Box and General Discussion.

The Board of Directors of the National Association of Waste Material Dealers, Inc., have authorized the formation of a Salvage Division and any industrial corporation wishing additional details can receive same by addressing the Association's Secretary, Charles M. Haskins, Times Building, New York.

December 22, 1927. CHARLES M. HASKINS.

LIGHTING EQUIPMENT ASSOCIATION

HEADQUARTERS, 711 GRAYBAR BUILDING, NEW YORK

January 25-26-27-28, 1928, Winton Hotel, Cleveland, Ohio, are the dates and place set for the Annual Meeting of the Artistic Lighting Equipment Association. At this meeting will be held the election of officers for the ensuing year.

City Manager, William R. Hopkins, will welcome the delegates and ladies. The meetings will be addressed by prominent speakers, including Rabbi Abba Hillel Silver, President Fred R. Farmer of the A. L. E. A. and others.

At this meeting the complete 1928 program of activities of the organization will be presented, embracing a refixturing and replacement campaign, designed to create a greater consciousness on the part of the public and the trade as to what constitutes good modern designed lighting equipment, and to show its place in the artistic decoration of home or building.

Complete details concerning the National Lighting Equipment Exhibition to be held in Chicago, June, 1928, will be presented. This Exhibition, conducted under the direction of the Artistic Lighting Equipment Association, is an outstanding event in the industry, presenting as it does an opportunity for Architects, Builders, Department Store and Furniture Buyers, Dealers and Jobbers to view all that is best in modern-designed lighting equipment, parts and supplies. Under one roof will be shown the latest designs in Floor and Table Lamps, Metal Furniture, Novelties, Wall Brackets, Chandeliers, Industrial and Church Lighting, Show-Window Lighting, Reflectors, Wiring Devices, Parts and Supplies, even to the most modern finishes produced for lighting equipment.

It is the educational exhibit of the lighting equipment industry showing as it does the progress in new designs and advancement in lighting.

DECEMBER 12, 1927. G. P. ROGERS.

BRASS MANUFACTURERS

HEADQUARTERS, CITY HALL SQUARE BUILDING, CHICAGO, ILL.

The National Association of Brass Manufacturers was disbanded in April, 1927, when W. M. Webster, Commissioner, resigned from the organization to retire from business.

Personals

WILLIAM R. WEBSTER

William R. Webster, vice-president of the Bridgeport Brass Company, Bridgeport, Conn., and president of the American Tube and Stamping Company and the Automatic Machine Company, is one of the leading authorities in the country today on copper, brass and bronze.

Mr. Webster was born in Oyster Bay, Long Island, his family being of Connecticut stock. He attended Betts Academy, Stamford, and Norwich Free Academy and in 1890 graduated from Cornell University with the degree of Mechanical Engineer. For two years thereafter he was associated with Westinghouse, Church, Kerr and Company. In 1892 he was employed by the Aluminum Brass and Bronze Company which afterwards became the Housatonic branch of Bridgeport Brass Company. During the depression of 1893, Mr. Webster became Superintendent of the Bridgeport Copper Company, one of the pioneer producers in this country of electrolytically refined copper, which position he held until 1897, when he entered the employ of Bridgeport Brass Company as foreman of its rolling mill.

WILLIAM R. WEBSTER

Gradually, through his ability and broad knowledge of the brass industry, he became successively Superintendent of the Raw Material Departments, General Superintendent and, in 1914, Vice President, which position he now holds.

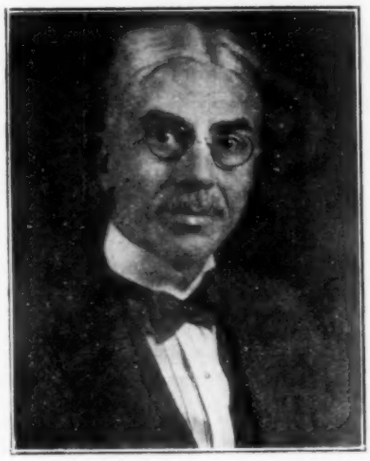
Mr. Webster is a Director of the Bridgeport Trust Company; a trustee of the Bridgeport Savings Bank; Treasurer of the Connecticut Steel Corporation, and is connected with a number of other institutions and enterprises. He is a member of the Finance Committee of the Bridgeport Financial Federation; Director of the Charity organization society and of the Bridgeport Young Men's Christian Association. He has been a member of the Bridgeport Board of Education, President of the University and Contemporary Clubs and is Chairman of the Board of Directors of the Bridgeport Engineering Institute.

During the war Mr. Webster was a member of the Connecticut State Council of Defense. He is a member of a number of technical societies in the United States and abroad, and a prominent figure in their special committees and advisory councils. He is also a member of several clubs in New York and Connecticut.

Robert Gray is now general superintendent of the Worthington Pump and Machinery Corporation, Harrison, N. J.

Thomas J. Llewelyn is manager of the Pittsburgh sales office recently opened in the Oliver Building by the Valley Brass and Bronze Company, New Kensington, Pa.

Walter Troop, sales manager of the North and Judd Manufacturing Company, New Britain, Conn., has resigned to become vice-president and sales manager of the O. B. North Company, Inc., New Haven, Conn.



R. S. BOYD

R. S. Boyd, general manager of C. G. Hussey and Company, Pittsburgh, Pa., resigned his position in April, 1927. Mr. Boyd will in the future devote himself to personal interests. In 1885 he started in the copper business as office boy with C. G. Hussey and Company.

William W. Cotter for the past thirty-two years with the Ansonia Branch of the American Brass Company, has resigned as an executive officer in charge of production and will manage the Extrusion Division at the Michigan Copper and Brass Company, Detroit.

George F. Anglin, for the past four years Pittsburgh Manager of the Torrington Manufacturing Company, Torrington, Conn., and the Blake & Johnson Company, Waterbury, Conn., before its merger with the former concern has joined the Machinery and Equipment Sales Department of Mackintosh-Hemphill Company, Pittsburgh, manufacturers of rolling mills and rolling mill equipment.

Otto Horix has taken over the Haller division of the McKenna Brass and Manufacturing Company, Pittsburgh, with a plant on Chartiers Avenue, and will operate it as the Horix Manufacturing Company, continuing the present line of bottling machines for still liquids. Mr. Horix recently resigned as general manager of the McKenna company, but still is a stockholder in, and a director of the company and its affiliated company, the McKenna-Horix Manufacturing Company.

Obituaries

HARRIS WHITTEMORE

Harris Whittemore, manufacturer and philanthropist of Naugatuck and of the Naugatuck valley, died at his home in Naugatuck, November 29, 1927. He was chairman of the board of directors of the Eastern Malleable Iron Company, which was founded largely by himself and his father through consolidation of many plants throughout the east, starting with the Naugatuck Malleable Iron Company. He was 62 years of age.

He was president and treasurer of the J. H. Whittemore Company of Naugatuck, president of the Colonial Trust Company of Waterbury, president of the Waterbury Hospital, president of the Westover School Corporation, director of the New York, New Haven and Hartford Railroad, the American Hardware Company, Landers, Frary & Clark, Blake & Johnson Company, treasurer and director of the Bristol Company, trustee of the Dime Savings Bank, Waterbury, director of the Eberhard Manufacturing Company of Cleveland, director of the Hartford & New York Transportation Co., director of the Liah Belt Company of Chicago, director Manufacturers Foundry Company of Waterbury, director of the National Malleable & Steel Company of Cleveland, the Naugatuck Savings Bank and the Naugatuck Water Company.

He was a member of the Waterbury Club, Waterbury Country Club, Naugatuck Golf Club, the Century, Metropolitan, Grolier and City Clubs of New York and director of the National Playgrounds Association. He was the son of John H. Whittemore, also a noted manufacturer and philanthropist. He made many liberal donations to Waterbury and St. Mary's Hospitals in Waterbury, the Red Cross and the Y. M. C. A.

WILLIAM L. BELKNAP, JR.

William L. Belknap, Jr., treasurer and general manager of the Belknap Manufacturing Company, Bridgeport, Conn., makers of brass couplings, gages and valves, died suddenly on November 23, 1927, at his home in Bridgeport, Conn.

JOHN M. JONES

John M. Jones, president of the Eastern Rolling Mill Company and the Baltimore Tube Company, Baltimore, Md., died at his home in Baltimore, November 1, 1927.

JOHN M. JONES

Mr. Jones, a leader in the steel and metal industry in the United States, was born fifty-seven years ago at Aberavon, South Wales. His father, the late David Morewood Jones, at that time was the district manager of a British steel company, and from his earliest years the son showed an interest in manufacturing.

Completing his education in the British public schools, Mr. Jones became associated with his father and was appointed manager of the Wolverhampton (England) branch of the Stephen Thompson Steel Company when 21 years old. A year before he had married Miss Dessie Griffith, of Swansea, Wales.

Mr. Jones came to the United States in 1916 and devoted most of his attention to steel interests and he also built up the Baltimore Tube Company. He was a member of several clubs.

Mr. Jones is survived by his mother, Mrs. Morewood Jones, of this city; his widow; three brothers, Thomas Jones and David Jones, of Baltimore, and Evan Jones, vice-president of the Ashtabula (Ohio) Steel Company, and two sisters, Mrs. Sarah Jones, of Baltimore, and Mrs. W. H. Davey, of Mansfield, Ohio.

JOHN A. TRAUTMAN

John A. Trautman, 40 years, assistant manager of the Ansonia Branch of the American Brass Company died at the home of his brother-in-law, Dr. William E. Anderson in Englishtown, N. J., after several months' illness December 20, 1927. He was born in Englishtown and has lived and worked in both Ansonia and Waterbury. He was a member of George Washington Lodge of Masons, Mount Vernon Chapter, Royal Arch Masons, Naugatuck Lodge of Odd Fellows, Hope Encampment and Ells-Wood Rebekah Lodge, all of Ansonia. He is survived by his widow, who was Miss May Hill of Shelton; two children, Elizabeth and John; his parents, Mr. and Mrs. Jacob Trautman of Englishtown; three sisters, Miss Katherine Trautman of Brooklyn, Mrs. Julia Howe of Yonkers and Mrs. William Anderson of Englishtown. The funeral was held December 22 from the First Methodist Church, Waterbury, with burial in Pine Grove Cemetery, Waterbury.

NEWS OF THE INDUSTRY

Industrial and Financial Events

DIE CASTING COMPANY DISSOLVES

Upon consummation of pending dissolution proceedings, the business and assets of Aluminum Die Casting Corporation, Garwood, New Jersey, will be sold.

TORRINGTON COMPANY EXTRA DIVIDEND

The Torrington Company, Torrington, Conn., declared regular quarterly dividend of 3% (75 cents) and extra dividend of 5% ($1.25) a share payable January 3, 1928.

WESTERN ELECTRIC DIVIDEND

The Western Electric Company declared a special dividend of $13 per share in addition to the regular dividend of 50c per share. Over ninety-eight per cent of the stock is held by the American Telephone & Telegraph Company, which, it is stated, will invest most of this dividend in telephone plants.

YALE & TOWNE EXPAND

The Yale & Towne Manufacturing Company, in a letter to stockholders, announces that negotiations with the Damm & Ladwig Company of Velbert, Germany, the largest European manufacturers of locks and builders' hardware, have resulted in a contract to purchase the latter company and control of two affiliated companies.

BRITISH ALUMINUM COMPANY EXPANDS

The British Aluminum Company is said to be making extensions to the buildings and plant of its Burntisland branch. The present capacity of the works is to be doubled. This measure has been rendered necessary by the development of the Fort William reduction works, which will require increased supplies of alumina from Burntisland

JOSEPH DIXON COMPANY DIVIDENDS

The ninety holders of the 50,000 shares of $100 par value Joseph Dixon Crucible Company stock have received cash dividends this hundredth anniversary year totaling 15 per cent., or $750,000, says an Associated Press Dispatch from Jersey City. The regular quarterly dividends of 2 per cent. have been paid. In addition, a 5 per cent hundredth anniversary dividend was declared last March and a similar 2 per cent dividend in December.

NORTON BUYS BETHEL-PLAYER

The Norton Company has purchased the entire capital stock of Bethel-Player & Company, Inc. of Westboro, Massachusetts, manufacturers of an extensive line of modern lapping machinery. It is the intention of the Norton Company to make these products in their Worcester plant and market them through the Norton Sales organization.

BALTIMORE TUBE OFFICERS

The Board of Directors of the Baltimore Tube Company, Inc., announce the election of Charles E. F. Clarke, as chairman of the Board and C. S. Inglis, as a director of the company, and the election of the following officers: C. S. Inglis, president and treasurer; R. S. Stringer, vice-president and sales manager; M. J. Callanan, vice-president and plant manager; E. G. James, vice-president and secretary; F. Willenburg, assistant treasurer.

CHASE BUYS BRASS CONCERN

The Chase Brass and Copper Company, subsidiary of the Chase Companies, Inc., of Waterbury, Conn., has announced its purchase of the assets of the Ohio Brass and Copper Company, of Cincinnati, O., from Henry E. Heitz, who was president of the firm, and his son, Arthur H. Heitz, secretary. The business will be continued without material change in either management or scope, except that a regular stock of Chase products will be added.

FEDERATED METALS GAIN

The Federated Metals Corporation in the six months ended on Nov. 30 had a net operating profit of $608,103 and a net income of $343,206, after all charges, including interest and depreciation, Ivan Reitler, vice-president and general manager, announced. Net sales exceeded $25,000,000.

"The company's financial position," he said, "is reflected by current assets of $10,201,708, as compared with current liabilities of $2,148,490. Bank loans were reduced during the last six months from $2,300,000 to $750,000. An initial dividend of 25c per share has been declared."

OKONITE BUYS HAZARD WIRE DIVISION

The Okonite Company, Passaic, N. J., has bought the insulated wire division of the Hazard Manufacturing Company, Wilkes-Barre, Pa.

BRIDGEPORT BRASS CHANGES

Carl Dietz, president of the Bridgeport Brass Company, has resigned, according to an announcement made in Bridgeport, Conn., January 10, 1928. R. T. Kent, general manager of the company, also resigned. Mr. Kent will be succeeded by Ralph Day, now general manager of the American Brass Company plant at Hastings-on-the-Hudson, N. Y. A successor to Mr. Dietz will be elected later.

ALLIED INDUSTRIAL COMPANY EXPANDS

This month marks the continued growth of the Allied Industrial Products Company by their purchase of the Peters Manufacturing Company, Wollaston, Massachusetts, manufacturers of Red Seal & Dixie buffs and also the purchase of the Buff and Wheel Company of Chicago, manufacturers of buffs, muslin wheels, sheepskin, canvas wheels, etc. The Allied Industrial Products Company formerly were Western Distributors for the Peters Manufacturing Company.

In five years time The Allied Industrial Products Company have grown considerably, and now have their own building at 120-126 N. May Street, Chicago, Ill., and also own property within eight blocks on which is contemplated the erection of a building for buffs and wheels only. The Company also manufactures metal cleaners and operates its own mine for plater's lump pumice.

POWER SHOW

The Sixth National Exposition of Power and Mechanical Engineering was held at Grand Central Palace, New York, December 5-10, 1927.

Metals played a most prominent vart in the exhibits, being shown either as such or as integral parts of mechanical devices. Among the firms present most directly interested in metals were the following:

Accurate Brass Casting Company, Brooklyn, N. Y.; A. Allan & Son, Harrison, N. J.; American Brass Company, Waterbury, Conn.; American Foundry Equipment Company, New York; Anaconda Copper Mining Company, New York; Armstrong Cork & Insulation Company, Pittsburgh, Pa.; Bearium Bearings, Inc.; Joseph Dixon Crucible Company, Jersey City, N. J.; Charles Engelhard, Inc., Newark, N. J.; General Refractories Company, Philadelphia, Pa.; Hardinge Company, York, Pa., Keystone Refractories Company, New York; National Lead Company, New York; Oakite Products, Inc., New York; S. Obermayer Company, Chicago, Ill.; Quigley Furnace Specialties Company, New York; Rome Brass Radiator Corporation, Rome, N. Y.; Scovill Manufacturing Company, Waterbury, Conn.

SILVERWARE MERGER

The consolidation was announced of the Reed & Barton Corporation, Taunton, Mass., and Dominick & Hoff, Inc., controlling the McChesney Company of Newark, N. J., all manufacturers of sterling silverware. President Sinclair Weeks of Reed & Barton said this would ultimately mean increased activity at the Taunton plant.

NEW PLATINUM REGULATION

The new Platinum Stamping law which was passed by the Legislature of New York State in March, 1927, became effective on January 1, 1928, and is drawn in conformity with the proposed national law, which will be reintroduced into Congress at the next session.

The State of Illinois followed a close second to adopt the platinum law. The National Jewelers Publicity Association of Newark said it expected that a similar act would be introduced in the Legislatures of other States.—New York Times.

ROOT COMPANY ANNIVERSARY

On November 1, 1927, the Root Company of Bristol, Connecticut, manufacturers of automatic counters and hardware specialties, commemorated the twentieth anniversary of the present corporation by the executives and foremen giving a banquet in honor of John T. Chidsey, President and General Manager of the company.

The Root Company is one of the oldest and foremost industries in the city of Bristol. It was in the early 1860's that the business was started by Joel H. Root for the manufacture of hinges and specialties.

LEAD SHIPMENT IN RIVER

Four hundred tons of lead went to the bottom of the East River November 12, 1927, when the scow upon which it had been loaded a few hours earlier sprung a leak and overturned while it was tied up to the dock at Montague street, Brooklyn. Several workmen on board at the time jumped to the dock when they felt their craft listing. The scow was owned by McAllister Brothers, of 17 State street, New York. The lead was to have been shipped to the American Smelting and Refining Company at Perth Amboy, N. J.

Divers will recover the lead from the river, which is about thirty feet at that point, it was announced.

Business Reports of The Metal Industry Correspondents

NEW ENGLAND STATES

WATERBURY, CONN.

JANUARY 3, 1928.

Although local business leaders a year ago had some misgivings about the year that is now past, 1927, brought the local industries quite as much business as the previous year. There has been no slackening except for a few weeks during the summer and business leaders look for increasing business for 1928.

Among important events during the past year was the purchased by the **Chase Companies, Incorporated,** of the **U. T. Hungerford Company,** the largest distributor of brass goods in the country. The local concern increased its capital stock from $10,000,000 to $12,000,000 to finance the purchase. The **Chase Brass & Copper Company** was formed as a subsidiary of the **Chase Companies** to take over the distributing business of the former **Hungerford Company.** The officers of the new company are: President, **F. S. Chase**; vice-president and general sales manager, **R. L. Coe**; vice-presidents, **J. R. Van Brunt, C. H. Krueger**; treasurer, **R. D. Ely**; comptroller, **W. A Purdy**; assistant comptroller, **E. H. Madison**; secretary, C. E. **Hart**; assistant secretaries, **G. S. St. John** and **Rodney Chase.** Messrs. Van Brunt, Krueger, Madison and St John were officers of the old Hungerford Company and the others are officers of the Chase Companies, Inc.

John A. Coe, president of the **American Brass Company** was elected a director of the **Anaconda Copper Mining Company** as a successor to the late **C. F. Brooker. Clarke Judd** of the Kenosha branch was elected a director of the **American Brass Company** as a successor to Mr. Brooker.

The machinery business of the **Blake & Johnson Company** during the past year was sold to the **Torrington Manufacturing Company.** The **American Brass Company** began the manufacture of "Everdur" taking it over from the **Du Pont Everdur Company.** The **Scovill Manufacturing Company** added **John P. Elton** to its directorate. Mr. Elton is president of Blake &

Johnson's and was formerly vice-president of the American Brass Company **Bennett Bronson,** one of the **Scovill Company's** vice-presidents and former head of the **Oakville Company,** now owned by Scovill was also added to the directorate. **E. W. Goss,** son of President **E. O. Goss,** was appointed assistant to the president.

The plant of the defunct **Connecticut Brass & Manufacturing Corporation,** formerly a $5,000,000 concern, was sold to **Schnee & Schnee** of New Haven at a bankruptcy sale for $79,000. The Waterbury Clock Company closed its branch plant, formerly the **Waterbury Watch Company,** later known as the **New England Watch Company** and more recently owned by the new defunct **Ingersoll Brothers Company.** The **Anaconda Copper Mining Company** purchased the **Detroit Copper & Brass Company** for about $12,000,000 and turned its operation over to the **American Brass Company.**

Edward A. Wells, general manager of **A. H. Wells & Sons,** died July 7.

Employes of the local branch of the **International Silver Company** last month received nearly $10,000 in service awards over and above their regular pay. There are 300 employes of the local plant and about one-third of them participate in the awards through having been five years in the company's employ. The company has 12 plants and the total of the service awards made to the employes of all plants amounted to $125,000.

Robert F. Griggs, president and treasurer of the **R. F. Griggs Company,** investment brokers, secretary and director of the American Mills Company, and director of the Blake & Johnson Company, the Manufacturers Foundry Company, the Waterbury Buckle Company, the Smith & Griggs Manufacturing Company, the Clark Brothers Bolt Company (Milldale) and the Mitchell Vance Company, New York, died at his home here Dec. 19, after an illness of several months. He was 57 years old. As founder of the oldest brokerage house in the city he has handled most of the capitalization changes of most of the local industries.

Directors of the **Scovill Manufacturing Company** at their meeting last month declared a quarterly dividend of 60 cents a share payable Jan. 3 to stockholders of record Dec. 22. The stock was put on a dividend basis of 60 cents a quarter over a year ago when the stock was split up and a 25 percent stock dividend declared. At that time the par value was reduced from $100 to $25, four shares of new were given for one share of the old and in addition an extra share of par value of $25 was given so the stockholders really received five shares for one. This dividend was increased to 75 cents a share in April and the latter rate was also paid in June, but now has gone back to the basis of a year ago.

Edward O. Goss, president of the **Scovill Manufacturing Company,** spoke on "Power" at the fourth annual meeting of the New England council, held in New Haven last month, the first time it has met in Connecticut. He is chairman of the council's power committee and spoke on the possibilities of super-power development in Northern New England and Canada and incidentally, control of floods in that section.

F. S. Chase, president of the **Chase Companies, Inc.,** was last month elected president of the Waterbury Hospital to succeed **Harris Whittemore** of Naugatuck, recently deceased. **John P. Elton** was elected vice-president, succeeding Mr. Chase. **John A. Coe,** president of the **American Brass Company** and **Roger Sperry,** assistant secretary of the **Scovill Manufacturing Company** were added to the board of directors.

John H. Goss, vice-president of the **Scovill Manufacturing Company,** was re-elected vice-president of the Connecticut Manufacturers' Association at the annual meeting held in Bristol early last month.

F. S. Chase is chairman of the **Leonard Wood Memorial** committee for this city and has opened its drive for funds to eradicate leprosy.

Clarence D. Chamberlin's announcement that he is to locate an airplane motor factory in New England has caused the local **Chamber of Commerce** to attempt to persuade him to locate here—W. R. B.

BRIDGPORT, CONN.

JANUARY 3, 1928.

Indications point to a continued strengthening of business for 1928, according to industrial leaders here. At least satisfactory business for the past year is reported by all plants. If not as much business as they would have liked all say they have nothing to complain about.

During the past year, **F. J. Kingsbury,** chairman of the board of directors, and former president of the **Bridgeport Brass Company** died, his death occurring July 11. **Robert T. Kent** was appointed general manager of the **Bridgeport Brass Company** during the year. **Warren D. Blatz,** sales manager of the same concern, was elected president of the **Bridgeport Sales Manager's Association.** A three-day conference of the salesmen of the company, numbering over 100 and located in all parts of the country, was held here last spring.

An addition to the city's industrial enterprises which will provide employment for from 1,000 to 2,000 people is expected to result from the proposed sale by the **Columbia Phonograph Company** to the **Bassick Company** or to the **Stewart-Warner Company** which controls the **Bassick Company,** of the empty five-story factory building of steel, brick and concrete of modern construction on Railroad and Howard Avenues. By an engineering mistake the building encroaches on the building line from 6 to 13 inches and application has been made to the city to clear the title. If this is done the **Bassick Company** will purchase it and start operations in the building which has been idle since soon after the war.

Arthur Slepian, assistant to General Manager **D. S. Starring** of the **Wheeler Insulated Wire Company** of Washington Avenue, has been appointed secretary of the company. He is a graduate of Harvard and the Massachusetts Institute of Technology.

The **General Electric Company** and the **Remington Arms Company** will receive the largest increases in tax assessments on this year's grand list, the assessors say. The raises will be close to $1,000,000 each. The raises are on the valuations of the buildings. It is expected that the **Crane Company** will be raised about one-third as much as the other two mentioned.

The employes of the **Remington Arms Company** raised $1,200 for Christmas baskets for the poor of the city. About 100 baskets were distributed and 2,000 children were given a Christmas tree party in one of the factory buildings. The committee in charge consisted of **L. J. Herrman, W. H. Skinner, A. B. Gully, W. T. Ashcroft, H. E. Graffin, W. H, Cairns, J. A. Ketchan, J. D. Kavanaugh, L. M. Blakely, J. H. Jennings** and **T. W. Hungerford.**

The entire front of the **General Electric Company** plant was covered with brilliant electrical illuminations during the Christmas season. Workmen spent three weeks arranging the display. A large white star at the top and center is the dominating feature and from it ropes of vari-colored lights are hung to resemble Christmas candles. A Christmas bell, Christmas trees and a huge "G. E." monogram were also shown in lights.—W. R. B.

CONNECTICUT NOTES

JANUARY 3, 1928.

NEW BRITAIN—Many changes in officials of local plants occurred during the past year through deaths. **Judge E. B. Bennett** was elected a director of **Landers, Frary & Clark** in February. **John P. Elton** of Waterbury and **Harris Whittemore** of Naugatuck were added to the directorate of the **American Hardware Company. Henry Russell,** former president of **Russell & Erwin,** died on June 3. **Benjamin A. Hawley,** Vice-president of the **American Hardware Company** and general manager of **Russell & Erwin,** died May 11, and **James Schilling,** former superintendent of **Russell & Erwin,** died May 21.

Walter Troop, sales manager for the **North & Judd Manufacturing Company** for many years, left here last month to take up his duties as vice-president of the **O. B. North Company, Inc.** of New Haven.

Lewis B. Beecher, supervisor of the **Stanley Rule & Level** division of the **Stanley Works** formany, years will retire from the company soon. Mr. Beecher will not disclose his future plans until after the first of the year.

BRISTOL—Bristol Brass Corporation directors at their meeting last month voted a regular quarterly dividend of 1¾ percent on the company's outstanding preferred stock, payable January 1, to stockholders of record December 9. The resumption of dividends on the preferred stock is taken to indicate a great improvement in the concern which has seen

rather slack business since the war. It has $620,000 worth of 7 percent preferred stock outstanding on which there are dividend accumulations of $26.25 a share. It is understood that the declaration of dividends last month indicates a plan for continuance of payment at this rate. President **Alexander** Harper describes business conditions at the plant as "fair" and that the company will share with the general prosperity anticipated for 1928. It is believed that the earnings for the current year will be in excess of $25 a share on the preferred, or 4 times the dividend requirement.

The company's statement as of Oct. 31, shows a substantial improvement over a year ago, or quick assets amounting to $1,170,904 compared to $1,007,052 a year ago. Bank loans and other payables amounted to $357,610 compared to $390,289 a year ago. The statement shows a surplus of $407,981.

TORRINGTON—The past year in Torrington has seen the transfer here by the **Torrington Company** of its plant in Manchester, N. H., and the purchase by it of the **Chicago Handlebar Company** of Shelby, Ohio. It moved the machinery of the latter plant here and brought about 25 of its employes. **Walter Thompson,** vice-president and general manager of the plant, also came here to have charge of the operations. **John A. Coe,** president of the **American Brass Company,** was elected president of the **Hendey Machine Company** in place of **Charles Alvord** who resigned.

The directors of the **Torrington Company** at their meeting last month declared an extra dividend of $1.25 a share and the regular quarterly dividend of 75 cents, both payable January 3 to stockholders of record, Dec. 15.

The **Torrington Company** has purchased all the property and rights of the **Tiley Pratt Company** of Essex, Conn., makers of wire spokes and nipples. The officers of the latter company are: President, **Charles B. Tiley;** secretary, **Richard B. Tiley;** treasurer, **Stillman B. Tiley;** superintendent, **Morton C. Tiley** and sales manager, **Paul L. Campbell.** The **Torrington Company** will continue to operate the plant at Essex, which employs about 100 hands, and retain **Morton Tiley** and **Paul Campbell** in charge.

ANSONIA—The principal industrial change in Ansonia during the year was the consolidation of the **Farrell Foundry Company** of Ansonia with the **Birmingham Iron Works** of Derby. The new concern, capitalized at $5,700,000, is called the **Farrell-Birmingham Company.**

STAMFORD—A contract has been made by the **Yale & Towne Manufacturing Company** to purchase the **Damm L. Ludwig Company** of Velbert, Germany, said to be one of the largest European manufacturers of locks and builders' hardware. It has three plants in Germany and one in Czecho-Slovakia. Yale & Towne has a plant at Alpona, Germany, which is expected will be consolidated with the Damm & Ludwig plant.

The **Yale & Towne Manufacturing Company** last month declared its regular quarterly dividend of $1 a share, payable January 3, to stockholders of record December 9.

James Charles Bennett of Stamford was last month elected vice-president of the **Westinghouse Electric & Manufacturing Company** of which he is also a director. He will be in charge of the treasury and accounting departments. He has been with the concern since 1886.

MERIDEN—Charges that $50,000 in silverware had been stolen by employes of the **International Silver Company** in recent months was denied by officials of the company at the trial here of **Joseph Demauro** and **Josephine Demagio,** employes charged with having stolen silverware "valued at $100." The attorney for the two employes denounced the Silver Company "for allowing such conditions to exist whereby employes have stolen $50,000 in silverware. Negligent operation of the factory have allowed this situation to arise." This statement was immediately denied by the officials who declared that 99 percent of the employes are honest and that even the one percent would not be dishonest if it were not for the fences through whom the goods are disposed. The two employes were sentenced to jail for four months and fined $200.

The **International Silver Company** last month declared its regular quarterly dividend of $1.75 a share on the preferred stock payable January 1, to stock of record December 15.

THOMASTON—The **Seth Thomas Clock Company** shut down for inventory from December 24 to January 3. The **Plume & Atwood Manufacturing Company** shut down from December 24 to January 2.

The **Seth Thomas Clock Company** directors last month declared the regular quarterly dividend of 1½ percent and also an extra dividend of 1 percent payable December 22, to stockholders of record December 15.

TERRYVILLE—Conditions at the **Eagle Lock Company** are improving following a slight recession two months ago. Three more departments went on full time last month, making six departments now on full time. There are still a number of departments on short time but it is said they will be on full time next month.

NAUGATUCK—A "Know Naugatuck" industrial exposition was held in the Y. M. C. A. gym here last month, showing the products made in most of the local factories. Among the concerns participating were the **Bristol Company, Eastern Malleable Iron Company, John M. Russell Manufacturing Company, Goodyear India Rubber Glove Company** and **G. I. R. Shoe Company,** the **Naugatuck Chemical Company, Naugatuck Refining Engineering & Machine Company,** the **Risdon Manufacturing Company** and the **Bronson Company.**—W. R. B.

PROVIDENCE, R. I.

JANUARY 3, 1928.

Prospective prosperity for practically all lines of the metal industries is indicated by careful surveys that have recently been conducted in all branches throughout Rhode Island. This is particularly true of the numerous branches of the manufacturing jewelry industry wherein factories that for many months have been on a part time schedule are now operating on a full time basis, while a number are even working overtime. To be sure, it is mostly on holiday orders, but the large number of "repeats" that are being received especially on staple lines, is indicative of a healthier condition than for a long time. In consequence the manufacturers are looking forward to continued activities well into the coming year.

Improved conditions in many of the metal trades have brought about a shortage in skilled labor, while among the building trades it is reported that building operations are at a peak never before attained hereabouts, although there is a tendency shown in some quarters toward an easing up of new work started. Never in the history of Providence has there been so many large contracts under way at the same time involving more than $10,000,000. This activity is naturally reflected all along the line and there is, generally speaking, a more healthy condition than for a long time.

Henry D. Sharpe and **Harry Parsons Cross** are among the Providence business men who are most prominently mentioned for nomination by the Republicans of Rhode Island for United States Senator in 1928. Mr. Sharpe is president and treasurer of the **Brown & Sharpe Manufacturing Company** and the latter is a director of the **Rhode Island Tool Company.**

The **Reynolds Company,** 7 Eddy Street, Providence, has outgrown its present floor space and has taken on about 4,000 square feet of additional space at its present location. The company has been installing new and up-to-date machinery and equipment in addition to its present facilities for manufacturing metal and rhinestone show buckles, dress and hat ornaments. They will also have a separate department for imported steel show buckles as since the recent return of the proprietor, **William Reynolds,** from Paris where he purchased many new styles there has been a greatly increased demand in this line of merchandise.

The **Phillips Lead & Supply Company** is planning for an extensive improvement and development of its business and to finance the expansion has given a mortgage of $68,000 on its lot and buildings at South Main, South Water and Power Streets, Providence.—W. H. M.

BOSTON, MASS.

JANUARY 3, 1928

Executive committee of the **New England Telephone & Telegraph Company** of Boston, has voted to spend $1,596,156 for new construction and improvements in plant.

Remington Rand, Inc., manufacturers of office equipment including filing cabinets, etc., are considering concentrating their production at either Holyoke or Cambridge. The former move seems more likely. The Cambridge plant is leased and the Holyoke plant is owned.

Recent incorporations include **Automatic Safety Valve Co.**, of Lynn to manufacture valves. Capitalization $10,000, **R. W. Reeves** of Lynn, treasurer and clerk. **American Battery & Radio Company,** to manufacture radio equipment, capital, $25,000, president, **E. P. Weber; W. W. Adrian Electrical Construction Company** Somerville, Mass., capital, $100,000; **American Metal Specialty Company, Inc.,** Boston to manufacture metal specialties for various purposes, Percy R. Seamon, president and treasurer, 159 Hancock Street, Cambridge; **A. C. Kennedy Radio Company,** Boston, **Andre D. Kennedy,** president, manufacture radio sets, capital, $40,000.

Funeral services for **Josiah Sibley Crapon,** New England manager of the **National Enameling & Stamping Company,** were largely attended. Mr. Crapon was 66 years of age and lived in Quincy. He was former president of the **New England Hardware Company.** He died on December 19, 1927.—H. A. L.

MIDDLE ATLANTIC STATES

ROME, N. Y.

JANUARY 3, 1928.

The most important development of the year in the local brass and copper industry was the recent announcement of the merger of the **Rome Brass Company** and the **Rome Manufacturing Company** into a single corporation with a capitalization of $10,000,000. Both companies long have been among the leading industrials in Central New York and the combination of the two under the name of the **Rome Brass Company** will make it one of the largest industries of any description in this area.

The Manufacturing company is a $3,000,000 corporation engaged in the manufacture of metal products, notably automobile radiators, brass tubing, ornaments and utensils. This business will be continued under the new directorate.

According to company officials a review of the industry for the past year shows business in 1927 to have been fully equal to that of 1926. Domestic orders were nearly equal to those of last year and there has been a slight increase in foreign shipments.

"Taken all in all," said an official of the Brass Company, "the year has been entirely successful. There have been periodic periods of depression, but the total output for the twelve months is shown by our records to be fully up to that of 1926, which was another prosperous year.

"We look for increased business during the coming year, despite the industrial nervousness usually associated with a national election. This expectation is based upon the reports of our sales forces and correspondents, and upon orders already booked for future delivery. From every point that we now can observe the prospect for the brass and copper industry looks bright. We believe there will be no let-down during the coming year, that there will be plenty of occupation for labor at relatively high wages and that there will be a general increase in the demand for products, starting early in the year and continuing throughout."

A smaller brass company here, dealing principally in tablets and brass and bronze castings, reports a successful year with a slight increase in the demand for ornamental as contrasted with utility work.

Outside evidences of the 1927 prosperity of the local brass and copper industry lie in the fact that the mills have been kept running steadily throughout the year. The depression felt in other lines with enforced lay-offs of prolonged duration have been entirely absent among the several thousands of employes engaged in the metal industry here.

Another evidence of the financial health of the business is found in the fact that the Brass Company started this year and now has nearing completion a large new plant to add to its buildings covering many acres in the eastern end of the city. In this plant is now being installed the most modern time-saving equipment known to the trade. Its operation will require the employment of several hundred more hands and probably the importation of skilled labor.

Officials of the company are withholding for the present the details of the new plant, an imposing structure of modern steel and brick construction. There are reports, however, that it is expected to increase their output by at least thirty per cent.—R. C. M.

NEWARK, N. J.

JANUARY 3, 1928.

The **Miner-Edgar Company,** manufacturers of chemical solutions in Blanchard Street, with principal place of business at 110 William Street, New York, has been adjudged bankrupt by Federal Judge Runyon. The order followed the filing of an involuntary bankruptcy petition with consent. Creditors named in the petition were the United States Alcohol Company of New York, Goldsmith Brothers, Inc., and the New York Dock Company. The liabilities of the concern, which operates plants in Belleville, Jersey City, Brooklyn and several other places besides Newark were estimated at $3,000,000. Assets were placed at $2,500,000. Judge Runyon appointed Zealey Gerber, general manager of the company; E. B. Wilson, of New York, and State Motor Vehicle Commissioner William L. Dill, receivers under joint bond of $25,000.

Newark concerns incorporated were: **Traffic and Safety Signal Company,** Newark, 1,000 shares no par, manufacture traffic signals; **Columbia Nipple Manufacturing Company,** $50,000, fittings and valves; **Edward H. Sinn, Inc.,** $50,000, pipes and fittings; **Hy-Grade Manufacturing and Plating Company,** $100,000, metal plating; **J. F. Newman, Inc.,** $125,000, manufacture jewelry; **Rex Jewelry Manufacturers, Inc.,** $125,000, manufacture jewelry.—C. A. L.

TRENTON, N. J.

JANUARY 3, 1928.

Confirmation of the sale of the plant of the **Jordan L. Mott Company** to a reorganization committee representing the **Laib Pottery Company,** of Louisville, Ky., was made by Judge Joseph L. Bodine in the United States District Court on December 19, 1927. The sale price was $1,650,000. The new owners, one of the largest pottery manufacturers in the South, expect to take possession of the plant immediately after settlement. The company, it was reported, will take over $1,500,000 in unfilled orders.

Attending the court session were former Judge George W. Macpherson, special master, who conducted the public sale of the plant; Charles H. Baker and Robert K. Bowman, receivers, and Edwin A. Potter, vice-president, of the Guaranty Trust Company, of New York, member of the reorganization committee. The purchasers have sixty days to make final settlement and certain financial matters will have to be first considered, but no delay is expected in completing the transaction. The judge's decision ended approximately three and one-half years of bankruptcy litigation since the receivers were appointed. The present working force of 1,200 persons working at the Mott plant will be considerably increased when the Laib corporation puts into effect its plans for capacity production. The Laib company has two plants that are being operated successfully in the South. Elihu Root, Jr., of New York, was legal adviser for the reorganization committee. The plant of the Mott company was established in Trenton 25 years ago and was long one of the largest concerns of its kind in the country. Finally the business became insolvent.

Trenton metal manufacturers report that business in some departments is slackening up a little, but they are expecting conditions to improve late in the winter. Manufacturers say the first six months of the year found business good, but the last six months showed a dropping off.

A number of new concerns have been chartered here, some of which are: **Joseph Lapelosa, Inc.,** New Brunswick, $50,000 capital, manufacture rubber and metal goods; **New Jersey Rural Gas and Electric Company, Inc.,** Watchung, 2,500 shares no par, gas and chemical apparatus; **Service Surgical Supply Company,** Paterson, $5,000, surgical appliances; **The Morning Clock Company,** Paterson, $125,000, manufacturing clocks; **Federal Aeroplane & Hydroplane Works, Inc.,** Jersey City, $500,000, manufacture aeroplanes; **Roller Grinding and Machine Company,** North Bergen, $100,000; **Gerard Farepholz, Inc.,** Fairview, $2,000, manufacture chemicals; **H. Morser & Company,** Passaic, $50,000, manufacture jewelry.—C. A. L.

MIDDLE WESTERN STATES

CLEVELAND, OHIO

JANUARY 3, 1928.

Like other sections of the Middle West, where the non-ferrous metal industry is paramount, the year now drawing to a close is generally conceded to have been fair. Conditions have been more or less spotty, but as the year goes out there is much to encourage, and manufacturers in general are looking for an early revival of business in general. **Col. Leonard P. Ayres,** vice president of the **Cleveland Trust Company,** predicts that the new Ford car will usher in a period of intensive sales effort in the automobile industry never before seen, and that it surely will result in great additions to the number of two-car families. Believing that we now are in the closing phases of the business cycle begun in 1924, Col. Ayres advises a study of the number of blast furnaces in operation as a guide to when the cycle has reached its lowest point and the new upturn begins. The present prospects are, he says, that the conditions of general business will improve steadily.—F. J. H.

TOLEDO, OHIO

JANUARY 3, 1928.

The brass, copper and aluminum industry in Toledo has closed a fairly prosperous year. In fact, conditions throughout the twelve months have been better here than in a number of places in the Middle West. This is due very likely to the fact that industries which use these products are more varied than in many other cities. Toledo has such a diversified industrial group that a slow down in business does not affect all alike.

The outlook for 1928 is promising, and the general forecast is that business will exceed 1927 in every way. Already plants are preparing for an early increase in production. This is particularly true in the motor car field which has been lagging during the last quarter of 1927.

Articles of incorporation may be redrafted by the **DeVilbiss Company** if plans are carried out at a special meeting of stockholders following the annual session which takes place in January. Announcements along this line were recently mailed to stockholders, it is stated. If the change is made, directors will be authorized to fix the dividend rate and redemption price on unused preferred stock not in excess of seven per cent, or 50 cents per share premium for redemption. This plan, it is said, would permit directors to issue a series of preferred stock at a smaller dividend rate than at present permitted should market conditions justify such action. There would be no change in the dividend rate nor in conditions of present outstanding preferred shares. **T. A. DeVilbiss,** president of the company, states that the move is planned so that the company may be prepared to take advantage of better market conditions for its securities in future financial movements.—F. J. H.

DETROIT, MICH.

JANUARY 3, 1928.

The metal industry in Detroit and other parts of Michigan are closing 1927 with no regrets and with intensive hopes for improved conditions in the future. The management of practically every manufacturing plant is optimistic and anticipates an early upturn of business for the new year. While many plants have not met with every success that was expected at the start of the year, conditions might have been worse.

Most of the brass, copper and aluminum plants have operated quite continuously. All have met with more or less competition, but that was expected.

The motor car plants, on which the metal industry depends to a great extent, in this territory at least, seems to have passed over its former depressed condition and is now on an upward trend, but it is not as pronounced as some have hoped for.

The new year, in every way, however, has bright prospects.

According to **K. D. Cassidy,** an expert on market conditions, the demand for non-ferrous scrap in the Detroit territory is fairly satisfactory. Increased inquiries are being received and dealers and smelters are optimistic over the outlook for the first quarter of the new year. At present individual orders continue small, but there seems to be a tendency to order in increased amounts.

Copper and brass bearing scrap is in fairly good demand. Lead scrap also is moving quite freely. Aluminum scrap, however, continues weak.

The **National Porcelain Enameling Company,** Freeland and Elmira streets, Detroit, has recently taken out incorporation papers. Its capital stock is $75,000.

The **Peninsular Stove Company,** when it opened its new plant in Brightmoor village, a suburb of Detroit, on December 15, employed mass production methods, similar to those used by the motor car industry. Only a few years ago stove manufacturing topped the list of Detroit's industries. Then the automobile came and stoves passed to the background. Now this new and big stove plant has adopted the assembly line as one of its modern manufacturing methods. This means that the uncompleted stove is started at the end of a long line and is passed from one process or movement to another, when it finally emerges a completed article, after the same plan as a new motor car coming into existence.

Operations have recently been started in the plant of the **Walker Electric Refrigeration Company** at Port Huron, which recently was moved from Detroit. **H. J. Walker,** president and manager, states that production capacity will be 150 electric refrigerators a day for the first year.

The **American Lubricator & Brass Company,** Detroit, has recently taken out incorporation articles, for the purpose of dealing in and manufacturing oiling devices. The capital stock is $25,000. The stockholders are Athony Bodde, Edwin A. Burch and Homer D. Coleman, 2731 West Grand avenue, Detroit.

Detroit friends regret to learn of the death of **Michael Reid,** formerly of the **Detroit Copper & Brass Rolling Mills,** which took place at his home in Buffalo, N. Y. At the time of his death, Mr. Reid was superintendent of the **American Brass Company,** at Buffalo. He is survived by a widow and three children.

The **Moisture Valve Corporation** has recently taken out articles of incorporation in Detroit. It will deal in valves, automobile accessories, etc. The stockholders are Edward McCann, Ernest C. Badger and Paul F. West, 1191 West Philadelphia avenue, Detroit.

Battle Creek has acquired a new industry, the **Standard Plating & Novelty Works,** which succeeds the **Queen City Plating & Novelty Works.** The former company, it is stated, has leased the factory occupied by the **Cole Manufacturing Company** and will start on production in the near future. Edward Holden, of Kalamazoo, and C. A. Crippen, of Battle Creek, are co-partners. The former is salesman and the latter factory manager.

R. G. Richards, formerly connected with the **Slaymaker Electric Welding Company,** Detroit, has taken a similar position, it is announced, with the Barnes Wire Fence Company. —F. J. H.

CHICAGO, ILL.

JANUARY 3, 1928.

Most of the Chicago metal trades continue busy, the most active of all being those devoted to decorative art fixtures for architectural purposes and art lamp fixtures. All these firms have had a busy year though not quite as good as last year.

Copper and brass are the most in demand in these plants. The bicycle and motorcycle industry represented by the **Arnold Schwinn Manufacturing Company,** manufacturers of Excelsior bicycles and motorcycles, is doing a very good business compared to the last three years. This company does all its own nickel plating, having a large plating room at the rear of one of their plants.

The **Superior Motor Company** is producing quite a lot of brass tone arms for Brunswick phonographs. The plating is done in this plant also.

Disappearance of an entire carload of pig tin, weighing thousands of pounds and valued at $36,000, baffled the police of Chicago. **H. Feinberg,** owner of the **Chicago Smelting and**

Refining **Company,** was questioned at the detective bureau. Feinberg said he recently ordered the carload of block tin from New York and was informed that it was ready to be unloaded at the New York Central team tracks near his smelting plant. When he sent over to procure the metal he found the car empty, police were told.

The **A. V. Boetter Manufacturing Company** was capitalized for $10,000 by Charles S. Knudson, E. H. Luebeck and William S. DeVenish. The company will manufacture and deal in metal and alloys and all by-products thereof.

The **S & S Engineering Company** was incorporated with a capital of $20,000 by Mitchell Edelson, David W. Labkon and Lillian Lachman. The company will manufacture machinery, and engineering and hardware specialties.—A. P. N.

MILWAUKEE, WIS.

JANUARY 3, 1928.

The mainstay of six thriving Wisconsin cities, eleventh among Wisconsin's industries and a world beater in its field, is the record of Wisconsin's aluminum business. However, it is in the utensil manufacturing field that the most profitable season was had. In Manitowoc, Wis., the **Aluminum Goods Manufacturing Company** produced most of the finished product. The Aluminum Goods company also operates a factory in Two Rivers, Wis., and employs in both factories over 3,500 workers. Plants manufacturing aluminum products, in Kewanee, Chilton, Kewaskum and West Bend also have had a very successful year.

Other manufacturing plants both in the city of Milwaukee and in the state had equally good years, especially those manufacturing radiator furniture, metal fixtures and other products. The **Specialty Brass Company** of Kenosha, Wis., manufacturing creamery fittings, is one of the best situated factories in the state, being a short distance from the cheese and other dairy product manufacturing centers. Its business is mostly derived from these sources and the wonderful growth of the dairy industry reflects the firm's prosperity.

Kohler Company of Kohler, Wisconsin, manufacturers of plumbing equipment and supplies, has had a very successful year and at present are the only rivals of Crane Company in this part of the country. The company's products were extensively sold and used throughout the year, and in the opinion of company officials the prospects of another good year are very promising.

Other firms report equally good years. The **Milwaukee Lead Company,** the **National Lead Company,** and **Roberts Brass Company** have been going along well during the most part of the year. The year has been in general somewhat above last year, more sound and stable and production was mostly on orders.

Morris Foundry, Inc., Fondulac, was incorporated by Newton Morris, Pearl Morris and Florence Morris for the manufacture of bronze, brass and aluminum castings, etc. The firm was capitalized for 1,000 shares at $100 a share.

The **West Bend Aluminum Company,** of West Bend, Wis., is making an addition to its offices, according to reports. The addition will be a two-story building 50 by 30 feet.—A. P. N.

OTHER COUNTRIES

BIRMINGHAM, ENGLAND

DECEMBER 10, 1927.

An advance has been declared in copper sheets and rods of £2 per ton and copper tubes of ¼d per lb. Other descriptions of non-ferrous material are likely to advance in proportion owing to the large rise in the price of copper due, it is believed, to the strong control exercised by America. The brass manufacturers are making good demands for material upon the mills. Shipbuilders are sending good orders for tubes and this business looks like expanding during next year.

Makers of electrical accessories are fairly busy owing to good domestic demand, although a larger volume of trade was in hand this time last year. The requirements of wireless fitments keep a number of the shops busy and their production keeps a number of factories active. The popularity of electric light has created an industry in itself of which Birmingham has become the recognized center for Great Britain.

In regard to employment the brassworkers' union has a few members out of work, but there is a need for skilled men to carry on the work of casters and a regular supply of non-ferrous pipes and fittings is called for.

The cutlery and plate works are still busy in Sheffield in the production of goods for Christmas sale. The demand for copper tubes for water conveyance is growing and is gradually covering the whole of the country. Copper is undoubtedly becoming much more popular than lead for domestic water conveyance, and will eventually become universal.

Birmingham manufacturers are very much disturbed over the proposals for the amendment of the Australian tariff. They are expected to press heavily on aluminum and enameled ware, kitchen ware, motor car accessories, and are especially discouraging to those who have seen for many years the loyal efforts made by Australia to give encouragement to trade with Great Britain. The manufacturers of aluminum goods take seriously the proposal that the tariff shall be increased 10 per cent. At present it is from 25 per cent to 35 per cent on all goods that go on the stove, and at present Australia is the best market for aluminum ware. Inasmuch as Britain is the largest purchaser of Australia's produce, a strong point is made of the desirability of arriving at a working understanding.—J. H.

Business Items—Verified

Curtis & **Tompkins,** San Francisco, Calif., announce their removal to 236 Front Street, San Francisco.

Baltimore **Brass Company,** 1201 Wicomico Street, Baltimore, Md., reports that business has been very good since May, 1927.

The **Detroit Lubricator Company,** Detroit, Mich., reports that they have no building plans under immediate consideration, contrary to the statement published in another journal.

Jacob **& Company, Inc.,** 631 South Delaware Street, Indianapolis, Ind., manufacturer of metal and wood patterns, etc., has awarded a general contract for two one-story additions, 60x90 ft., and 25x60 ft.

Charles **F. L'Hommedieu & Sons Company,** Chicago, Ill., manufacturers of platers' equipment and supplies announces that its agency in Los Angeles, Calif., operated by W. E. Hussander has been moved to a new address at 2810 S. Main Street.

Malcolm **Owen, Ltd.,** 54 Newcomen street, London, S. E. 1, England, are interested in securing representation or agencies by American manufacturers, particularly in connection with the grinding, polishing and electro-deposition trades in England.

The **Condit Electrical Manufacturing Company,** 1376 Hyde Park Avenue, Boston, Mass., will make some plant additions. This firm operates the following departments: brass machine shop, tool room, cutting-up shop, plating, japanning, stamping, soldering, polishing, lacquering, grinding room.

Standard Calorimeter Company, 52nd Street and Fifth Avenue, Moline, Ill., announces that their new plant will not be occupied until next spring. The foundry building is now complete and in operation. This firm operates a brass, bronze and aluminum foundry and manufactures Illium, a nickel-chrome acid resisting alloy.

The **West Bend Aluminum Company,** West Bend, Wis., is constructing an addition to its main shop to be used for manufacturing, storage and office purposes. This firm is the originator of the waterless cooker, and manufactures a complete line of high grade aluminum cooking utensils, and aluminum and steel stampings of all kinds.

The **Chromium Process Company** of Derby, Conn., which is engaged in the process of electro-deposition of chromium on all metals subject thereto has acquired the plant of the Maxim Munitions Company, owned by the Sponge Rubber Products Corporation, and will start operations immediately under the management of **Norman Tice,** of New Haven.

Channing & Bowman Company, Meriden, Conn., will enter the flatware manufacturing field with chromium plated flatware.

The **Lincoln Electric Company,** Cleveland, Ohio announces the transfer of E. F. Hoff from the Welder Division at Cleveland to the Welder Division at New York where he will be in charge of Welder Service under the direction of G. N. Bull, district manager.

The **Alchrome Bearings & Castings Corporation,** Cheshire, Conn., has established sales agencies with the following companies: Park & Williams, Inc., Philadelphia; Verner Steel Products Company, Chicago, and the Modern Engineering Company, Pittsburgh. The Alchrome Corporation operates a foundry for brass, bronze and aluminum castings.

The **Lincoln Electric Company,** Cleveland, Ohio, announces the transfer of **John Van Horne** from Atlanta to Moline, Illinois, where he will be located at 514½ Fifteenth Street, covering the Tri-Cities, on the sale of "Linc-Weld" Motors and "Stable-Arc" Welders. He will operate under the direction of **R. D. Malm,** Western Manager at Chicago, Illinois.

The **Hazard Manufacturing Company,** Wilkes-Barre, Pa., manufacturer of electrical wires and cables has moved its Chicago office to 1840 Midland Building, 168 West Adams Street. The Chicago office and warehouse of the Hazard Wire Rope Company, manufacturer of wire rope and wire rope fittings, now separate and distinct from the Hazard Manufacturing Company, will be retained at 30 S. Clinton Street.

Scully, Jones & Company, 2012 W. 13th Street, Chicago, Ill., manufacturers and jobbers of foundry equipment have purchased from Joseph A. Golde the holding formerly occupied by the Pridmore Company, on the corner of W. 19th and Rockwell Streets. The plant contains approximately 40,000 sq. ft. of floor space which enables the Scully company to consolidate the tool plant, formerly on 13th Street, and the warehouse and rebuilding shop located at 3609 S. Ashland Avenue. This firm operates a tool room.

The **Twentieth Century Brass Works,** 518 Fifth Avenue, Minneapolis, Minn., is constructing a new factory building at East Hennepin and Twenty-seventh Avenues. The new plant will nearly triple the capacity of the present factory and the payroll will be increased from 50 to 100 men. The building will be one-story structure of brick and concrete. This firm specializes in the manufacture of bronze bushings for automobiles and industrial uses. The following departments are operated: brass, bronze foundry; brass machine shop, tool room, grinding room.

INCORPORATIONS

The **Phelps Foundry Company, Inc.,** is new name of the foundry operated in Ansonia, Conn., by H. D. Phelps. The change is in name only as Mr. Phelps will continue to operate the business.

The **Olson Die & Manufacturing Corporation,** 63-65 Twenty-fifth Street, Guttenberg, N. J., has been organized to manufacture tools and dies, specializing in die casting dies, and will also do metal stamping. A plant is in operation and all machinery has been purchased.

The **Alloys Refining Corporation,** Guaranty Building, Indianapolis, Ind., has been formed to engage in the business of secondary smelting and refining. This corporation will produce babbitt, solder, type metal and brass ingot. Charles T. Bragg, formerly of Detroit, is managing director.

S. S. Paymer, N. Sacks and **E. M. Paymer,** formerly of the Central Smelting & Refining Works, Inc., 357 Borden Avenue, Long Island City, have incorporated the **Central Smelting & Trading Company, Inc.** A modern smelting and metal plant has been erected at 835-843 Humbolt Street, Brooklyn, N. Y.

Fulton-Harwood Brass & Aluminum Company, 1508 South William Street, South Bend, Ind., has been incorporated with capital stock of $225,000, to buy, sell, manufacture, fabricate and generally deal in all kinds of brass, aluminum, steel and iron. The following departments will be operated: brass, bronze and aluminum foundry; brass machine shop.

The **Galvanizing & Plating Company of Texas,** 3205 Engelke Street, Houston, Texas, has been organized to do a jobbing business in hot dip galvanizing, with ample facilities for material 37 feet 9 inches long x 42 inches wide and its daily capacity will be 30 tons. Later, this company will engage in tin plating and cadmium plating. A manufacturing building is practically completed and equipment has been purchased.

The **Enduro Manufacturing Company, Inc.,** 14 Franklin Street, Rochester, N. Y., has been organized to manufacture the Duroflex telephone bracket in cast iron and aluminum. The company will use aluminum and iron castings, steel rods in needle bar quality, threaded pins of needle bar steel and brass cap nuts and washers made true to size in nickeled steel and fiber. The company is in the market for brass knurled screws and nuts, and brass cap nuts. The Enduro company is doing its own manufacturing aside from castings.

Review of the Wrought Metal Business

Written for The Metal Industry by J. J. WHITEHEAD, President of the Whitehead Metal Products Company of New York, Inc.

JANUARY 3, 1928

During December many large orders were placed for fabricated brass and copper materials, in the form of sheets, rods, tubes and wire. Some of this business is attributed to buying induced by the strength of the copper market and is regarded as an expression of confidence in the market by the buyers. Shipments were also fairly heavy, some mills reporting that December deliveries were considerably in excess of any of the preceding two or three months. In addition to the orders on which December delivery was specified, there were some large specifications placed for delivery in January, as a consequence of which nearly all the mills are entering the New Year with order books in satisfactory condition.

A strong feeling of optimism is noted as to the first four or five months of 1928. It is not expected that the prospective trend in industry has any likelihood of developing into the proportion of a boom, but rather that there will be sufficient activity to keep the mills going along lines that are sound and reasonably profitable.

Prices for fabricated copper and brass materials are now at a level from ⅜ to ¾c per pound higher than on December 31st, 1926. From that date there was a general decline until June 1927, at which point the lowest prices for the year were reached. Since then there has been a general recovery with present quotations about 1½c per pound above the low June level. The price fluctuations of course are a direct reflection of the ingot copper market, which during the last six months has had a decided turn for the better. With demand continuing on a large scale, it is reported that the current level will be maintained if not advanced to higher prices. Predictions are made that consumption in 1928 will be in record breaking volume, but the more conservative elements are giving some thought to the fact that this is a presidential year, and will be content if conditions in the industry can be continued as they are at present. In view of the fact that several expected booms failed to materialize in 1927, most factors in the industry are rather slow about predicting any more bulges in activity, and would be quite content to continue along present lines. However, all the industries consuming fabricated non-ferrous metals are expecting an active demand for their products for the next six months. The automobile manufacturers are expecting a heavy volume of business after the January show. From a compilation of building reports it would appear that the present high rate of activity will be maintained. The building business which consumes large quantities of sheet copper, brass pipe and Monel metal is indicated to have been on a scale as to actual volume of construction operations about 5% greater in 1927 than 1926. Building for engineering work including public utilities and municipal construction is still going forward at the high rate established in 1927, and consumption of non-ferrous metals in these lines will be heavy.

The textile and chemical industries are prosperous and in these lines the use of Monel metal as well as copper and brass has reached large proportions and apparently there is no indication of a decreasing demand from this quarter. Electrical

equipment manufacturers are also expecting a continuation of the large volume of business that has been the rule in the last few months.

Producers of Monel metal and nickel have had the best year since the war. New developments in these lines have followed closely one after another, with the result that both these metals have been applied to a continually expanding list of new uses. As the year ended the order books for these materials were in healthy condition, and prospects for a good volume of business never were brighter. Among other things a Monel metal street marker has been perfected, and some large installations marking traffic lanes have been made in the streets and parks of Chicago and Philadelphia. During the next month or two several important manufacturers of devices for use in household kitchens and retail stores will announce in a national advertising campaign the fact that they have adopted Monel metal for their devices, and this is expected to be an influential factor in heavily increasing the sale of these articles as well as of the metal itself.

It may be said in reviewing the year that practically all factors in the fabricated metal industry are content with the results of the past year, and are looking forward with a well grounded feeling of optimism for an equally good, if not better year ahead.

Metal Market Review

Written for The Metal Industry by R. J. HOUSTON, D. Houston & Company, Metal Brokers, New York

COPPER

JANUARY 3, 1928

The volume of business in copper reached large proportions in 1927, although total domestic shipments were under those in 1926. Exports, however, were extraordinarily heavy, and were a reflection of the expanding European demand. The enormous sales for foreign consumption have made an impressive showing and latterly have proved the backbone of the market. The market passed through frequent changes and some fluctuations, but during the last quarter of the year outstanding developments took definite form which have had a stabilizing influence on the entire situation.

The Copper Exporters, Inc., and the more recently organized Copper Institute represent a concentration of effort to advance the interests of the copper industry. The leading producing companies of the United States are members of these organizations, and the co-operation of the principal producers will undoubtedly prove a notably constructive and beneficial movement. The industry as a whole will be in possession of statistics and data regarding the consumption and sales of copper, and the cost of producing the metal. A broader range of information will be increasingly valuable and should tend to prevent an unhealthy over-production which has so often resulted in disastrous and costly conditions. The effect of the new policies has been a higher level of market prices, and a realization that the whole position of copper is now under strong control. Producers enter the new year in a more optimistic frame of mind.

At the beginning of December the market price of electrolytic copper was 13⅞c to 14c delivered to Connecticut Valley points. The export price was 14.15c c.i.f. European ports. Offerings at these figures were quickly absorbed, and the market developed stronger tendencies until the domestic price reached 14⅛c to 14¼c, with the export quotation firmly established at 14½c c.i.f. foreign delivery. During the last two weeks of the old year market conditions were comparatively quiet, and in this rather slack period some custom smelter sales were reported at 13¾c. Latterly the low-price offerings disappeared and the market closed generally speaking at 14c to 14⅛c delivered terms.

The following statistics show the movements in refined copper during 1927, compared with those for 1926, in pounds. December 1927 figures are estimated:

	1927	1926	Inc.	Dec.
Production ..	2,940,181,090	2,880,908,000	59,273,090	.....
Domestic deliveries ..	1,666,869,818	1,804,348,000	.....	137,478,182
Export shipments .	1,261,588,363	1,051,722,000	209,866,363	.....
Stock on hand at end of year	182,724,909	171,002,000	11,722,909	.....

The sensational increase in exports was the outstanding feature in 1927. Domestic consumption was lighter than in 1926, while production more than kept pace with all previous records. The statistics for the past year are most suggestive. They emphasize the need for constructive unity, and whole-hearted efforts to keep production down to demand.

ZINC

A number of unfavorable developments in 1927 seriously affected market values. The protracted prevalence of low prices was a notable feature of the situation for many months. Consumption was in good volume, but did not keep up to the 1926 scale. Production was curtailed somewhat but not enough to safeguard the market and correct the downward tendency. Prices at end of December were 5.65c per pound, East St. Louis and 6c at New York. These quotations compare with 7.02½c East St. Louis one year ago. There has been relative over-production of zinc, and this has resulted in the leveling process in prices both for the ore and the metal in slab form. Stocks of slab zinc in smelters' hands on December 1, 1927, amounted to 39,320 tons, being an increase of 3,097 tons since November 1, 1927. There was a further gain in surplus stocks during the first half of December, making the latest figures read 42,932 tons. Production during the first half of December amounted to 25,405 tons, and shipments were 21,793 tons for the first half of December. Domestic stocks on January 1, 1927, amounted to 21,887 tons, or a little more than one-half the present excess supplies.

TIN

The year 1927 was one of many drastic readjustments in market values of tin. During the first half of the year extremely high prices prevailed, but conspicuous weakness was of frequent occurrence during the last half of the year. Deliveries of tin in the United State in the first eleven months of 1927 amounted to 67,955 tons, against 71,545 tons in the corresponding months of 1926, showing a decrease of 3,590 tons. American takings last year were also smaller than in 1925. World's visible supply on December 1, 1927, however, was only 14,594 tons, compared with 15,257 tons on December 1, 1926. But the average price of Straits tin during November 1926 was 70.67c, against the average of 57.63c for November 1927, a difference of 13.04c per pound.

The slump in prices in recent months cannot be primarily due altogether to the statistical position of tin. Some portion of the decline in market values must be attributed to speculative manipulation and not to excessively heavy stocks. Production has had the stimulating impulse of abnormally high prices for the last three years, and there are no outward signs that supplies are going to undergo a sudden huge increase. Most of the usual indices of consuming activity and prospects, however, are favorable for a steady world demand. The high price for Straits tin in 1927 was 71 cents, reached in February, and the low point was 56⅛ cents in November, a spread of 14⅞ cents a pound. At the year end the New York market for Straits was 57⅝c to 58c for January delivery, with tone steady.

LEAD

Market movements in lead during the year 1927 were subjected to a series of recessions in prices owing to periods of hand-to-mouth buying and signs of production running ahead of consumption as a temporary condition. The year came in firm, with a strong trend for the first quarter, which maintained the market at 7.35c to 7.65c New York basis. In April and May it began to decline until 6.20c was touched in July. From this low level, prices rose to 6.75c early in August, but the advance was not maintained and weakness developed which gave the market a setback to 6.25c in September. Since that time there has been some improvement arising from active demand and prospects of heavy consumption. Pronounced stability has been the feature during the entire month of December, and the outlook for business in lead next year is excellent. Recent outlet has been specially good. Heavy buying, both domestic and foreign, is expected in 1928 and the outlook is most promising for continued heavy consumption.

ALUMINUM

The leading producing company made a reduction of 70 points in aluminum prices, bringing them to the basis of 24.30c on 98-99% metal. Offerings of same grade in the outside market were made in the last days of the year at 23.90c. Consumers, however, are inclined to await further developments before making heavy commitments. Ample supplies and a reduction in demand from automobile makers have had the effect of bringing about lower prices. The market has been adjusted to the new basis, and the effect of price revisions are expected more definitely in the first quarter of 1928. The consuming outlook is good.

ANTIMONY

General demand for antimony was at a fair rate last year, but evidently not sufficient to prevent a downward trend in market prices. There were spurts of active buying from time to time, although the attitude of consumers was conservative and this policy was effective in getting important concessions. Chinese antimony at the close of year was quoted at 10⅞c duty paid, compared with 13c a year ago. The high point in 1927 was in April, with a quotation of 15½c. A low of 10¼c was reached in September. Antimony imports for the first ten months of 1927 amounted to 21,570,654 pounds, against 25,219,533 pounds for the first ten months of 1926. There was large scale buying in December at 11⅝c and 11¾c duty paid. Buying called for heavy forward deliveries, but on sudden cessation of demand the market eased off and gradually receded to the basis of 10⅞c at year-end. Recent stocks of antimony in bonded warehouses were reported at 1,497 tons. They are larger than a year ago. Prospects for consumption in 1928 are good, but market tendencies are difficult to predict, owing to the uncertainties surrounding the situation.

QUICKSILVER

There was a good deal of activity in the market for quicksilver during the year just closed. Prices were sharply advanced, and reached $128 a flask in November. Recent business has been only routine and price has eased off to $126. Imports in the first ten months of 1927 total 19,159 flasks, against about 21,000 in the corresponding period of 1926. Domestic output has increased.

PLATINUM

A weak situation developed in platinum last year, and prices of refined fell to $64 an ounce in June, compared with $101 to $102 in March. Large Russian supplies and sales caused the pronounced weakness. Present price of refined quotes $72 to $74 per ounce soft platinum.

SILVER

Protracted depression in silver, with frequent price fluctuations, have marked the progress of market movements during the past year. China and India were active buyers throughout the year and for a time prices stiffened moderately, but there was not enough propulsive force to send the price to a satisfactory level. Silver producers are complaining of existing conditions, especially for straight silver mines. High costs and low prices for the product are the immediate problems silver mine owners face. Silver output of United States for first eleven months of 1927 amounted to 54,464,000 ounces. Our exports of silver for the first eleven months of last year were $68,438,000, against $86,647,000 for the corresponding months of 1926, a decrease of $18,209,000. Imports of silver during the eleven month period in 1927 were $51,303,000, as compared with $65,166,000 for same period in 1926, being a decrease of $13,863,000. The New York quotation for silver at year-end was 57½ cents per ounce.

OLD METALS

Movements in scrap metals were in large volume in 1928, and from present indications secondary metals will continue to be in heavy demand for many months. Export buying of the copper and brass scraps has been specially insistent, and renewed large scale inquiries appeared at close of year. Supplies of scrap copper abroad are greatly reduced and this market is being sought for material wanted by European consumers. Prices on certain lines are therefore firmer and this tendency is likely to be more apparent early in 1928. New York quotations dealers pay quote at 11c to 11¼c for heavy copper, 9½c to 9¾c for light copper, 7¼c to 7½c for heavy brass, 8c to 8¾c for new brass clippings, 5½c to 5¾c for heavy lead; 3½c to 3¾c for old zinc, and 17c to 17¼c for aluminum clippings.

Daily Metal Prices for the Month of December, 1927

Record of Daily, Highest, Lowest and Average Prices and the Customs Duties

	1	2	5	6	7	8	9	12	13	14	15	16	19
Copper c/lb. Duty Free													
Lake (Delivered)	14.00	14.125	14.25	14.25	14.25	14.25	14.25	14.25	14.25	14.25	14.25	14.25	14.25
Electrolytic (f. a. s. N. Y.)	13.95	14.05	14.15	14.15	14.25	14.25	14.25	14.15	14.15	14.20	14.20	14.20	14.20
Casting (f. o. b. Ref.)	13.50	13.70	13.75	13.75	13.80	13.80	13.80	13.75	13.75	13.75	13.75	13.75	13.75
Zinc (f. o. b. St. L.) c/lb. Duty 1¼c/lb.													
Prime Western	5.85	5.85	5.875	5.85	5.85	5.825	5.80	5.775	5.75	5.725	5.725	5.70	5.675
Brass Special	5.90	5.90	5.925	5.90	5.90	5.875	5.85	5.825	5.80	5.775	5.775	5.75	5.725
Tin (f. o. b. N. Y.) c/lb. Duty Free													
Straits	59.00	58.875	59.375	59.125	59.00	58.50	58.625	58.625	58.625	58.625	58.625	58.50	58.125
Pig 99%	58.375	58.25	58.625	58.625	58.75	58.375	58.25	58.00	58.00	58.00	58.125	58.00	57.75
Lead (f. o. b. St. L.) c/lb. Duty 2¼c/lb.	6.40	6.40	6.45	6.45	6.425	6.35	6.325	6.325	6.325	6.325	6.325	6.30	6.30
Aluminum c/lb. Duty 5c/lb.	25	25	25	25	25	25	25	25	25	25	25	25	25
Nickel c/lb. Duty 3c/lb.													
Ingot	35	35	35	35	35	35	35	35	35	35	35	35	35
Shot	36	36	36	36	36	36	36	36	36	36	36	36	36
Electrolytic	39	39	39	39	39	39	39	39	39	39	39	39	39
Antimony (J & Ch) c/lb. Duty 2c/lb.	10.875	11.25	11.625	11.625	11.375	11.375	11.375	11.25	11.25	11.25	11.25	11.25	11.25
Silver c/oz. Troy Duty Free	58	58	58.375	58.50	58.125	58.125	58.125	58.375	58.375	58.125	58.125	58.375	58.125
Platinum $/oz. Troy Duty Free	66	66	66	66	66	66	66	66	66	66	66	66	66

*Holiday.	20	21	22	23	26	27	28	29	30	High	Low	Aver.
Copper c/lb. Duty Free												
Lake (Delivered)	14.25	14.25	14.25	14.25	*	14.25	14.25	14.25	14.25	14.25	14.00	14.23
Electrolytic (f. a. s. N. Y.)	14.20	14.20	14.30	14.30	*	14.30	14.30	14.30	14.30	14.30	13.95	14.200
Casting (f. o. b. Ref.)	13.75	13.75	13.75	13.75	*	13.75	13.75	13.80	13.80	13.80	13.50	13.748
Zinc (f. o. b. St. L.) c/lb. Duty 1¼c/lb.												
Prime Western	5.675	5.625	5.625	5.65	*	5.65	5.65	5.65	5.65	5.875	5.625	5.734
Brass Special	5.725	5.675	5.675	5.70	*	5.70	5.70	5.70	5.70	5.925	5.675	5.785
Tin (f. o. b. N. Y.) c/lb. Duty Free												
Straits	58.125	58.375	58.25	58.25	*	58.25	57.75	57.875	57.875	59.375	57.75	58.494
Pig 99%	57.625	57.875	57.75	57.875	*	58.00	57.50	57.625	57.625	58.75	57.50	58.059
Lead (f. o. b. St. L.) c/lb. Duty 2¼ c lb.	6.30	6.275	6.275	6.30	*	6.30	6.325	6.325	6.35	6.45	6.275	6.340
Aluminum c/lb. Duty 5c/ lb.	25	25	24.30	24.30	*	24.30	24.30	24.30	24.30	25	24.30	24.80
Nickel c/lb. Duty 3c/lb.												
Ingot	35	35	35	35	*	35	35	35	35	35	35	35
Shot	36	36	36	36	*	36	36	36	36	36	36	36
Electrolytic	39	39	39	39	*	39	39	37	37	39	37	38.81
Antimony (J & Ch) c/lb. Duty 2c/lb.	11.125	11.125	11.00	10.875	*	11.00	10.75	10.875	10.875	11.375	10.75	11.17
Silver c/oz. Troy Duty Free	57.75	57.25	57.625	57.625	*	57.50	57.625	57.75	57.50	58.50	57.25	58.06
Platinum $/oz. Troy Duty Free	66	66	66	66	*	66	67	67	67	67	66	66.13

*Holiday.

Metal Prices, January 9, 1928

NEW METALS

Copper: Lake, 14.25. Electrolytic, 14.35. Casting, 13.90.
Zinc: Prime Western, 5.675. Brass Special, 5.75.
Tin: Straits, 56.875. Pig, 99%, 56.125.
Lead: 6.50. **Aluminum,** 24.30. **Antimony,** 10.875.
Nickel: Ingot, 35. Shot, 36. Elec. 37. Pellets, 40.
Quicksilver: flask, 75 lbs. $126.00. **Bismuth,** $1.85 to $2.00.
Cadmium, 75. **Cobalt,** 97%, $2.60. **Silver,** oz., Troy, 57.625.
Gold: oz., Troy, $20.67. **Platinum,** oz. Troy, $72-74.

INGOT METALS AND ALLOYS

Brass Ingots, Yellow	10 to11
Brass Ingots, Red	12½to13
Bronze Ingots	12½to16
Casting Aluminum Alloys	21 to24
Manganese Bronze Castings	23 to40
Manganese Bronze Ingots	12½to16½
Manganese Bronze Forging	32 to40
Manganese Copper, 30%	25 to35
Monel Metal Shot	28
Monel Metal Blocks	28
Parsons Manganese Bronze Ingots	18¼to19¾
Phosphor Bronze	14 to15
Phosphor Copper, guaranteed 15%	18¾to21
Phosphor Copper, guaranteed 10%	17½to20
Phosphor Tin, guaranteed 5%	75 to80
Phosphor Tin, no guarantee	65 to 75
Silicon Copper, 10%....according to quantity	28 to32

OLD METALS

Buying Prices		Selling Prices
12¼to12¾	Heavy Cut Copper	13¾to14
12 to12½	Copper Wire	13 to13¼
10 to10½	Light Copper	11¾to12¼
10 to10¼	Heavy Machine Composition	11 to11½
8 to 8¼	Heavy Brass	9¼to 9½
6¾to 7	Light Brass	8 to 8¼
7¾to 8	No. 1 Yellow Brass Turnings	9¼to 9¾
9¼to 9½	No. 1 Composition Turnings	10¾to11
5¾to 6	Heavy Lead	6¾to 7
3¾to 4	Zinc Scrap	4¾to 5¼
9½to10½	Scrap Aluminum Turnings	12½to14½
14 to14½	Scrap Aluminum, cast alloyed	17½to18½
19½to20	Scrap Aluminum, sheet (new)	22 to22½
37½to39½	No. 1 Pewter	41½to43½
11½	Old Nickel Anodes	13½
17½	Old Nickel	19½

Wrought Metals and Alloys

COPPER SHEET

Mill shipment (hot rolled)	22c. to 23c. net base
From Stock	23c. to 24c. net base

BARE COPPER WIRE

15¾c.to 16c. net base, in carload lots.

COPPER SEAMLESS TUBING

24½c. to 25½c. net base.

SOLDERING COPPERS

300 lbs. and over in one order	21¼c. net base
100 lbs. to 200 lbs. in one order	21¾c. net base

ZINC SHEET

Duty sheet, 15% Cents per lb.
Carload lots, standard sizes and gauges, at mill, less 8 per cent discount ..... 10.00 net base
Casks, jobbers' price ..... 10.50 net base
Open Casks, jobbers' price ..... 10.75 to 11.25 net base

ALUMINUM SHEET AND COIL

Aluminum sheet, 18 ga., base price	38 c.
Aluminum coils, 24 ga., base price	32½c.

ROLLED NICKEL SHEET AND ROD

Net Base Prices

Cold Drawn Rods	53c.	Cold Rolled Sheet	60c.
Hot Rolled Rods	45c.	Full Finish Sheet	52c.

BLOCK TIN SHEET

Block Tin Sheet—18" wide or less. No. 26 B. & S. Gauge or thicker, 100 lbs. or more 10½c. over Pig Tin; 50 to 100 lbs., 15c. over; 25 to 50 lbs., 17c. over; less than 25 lbs., 25c. over.

SILVER SHEET

Rolled sterling silver 58¾c. to 60¾c. per ounce, Troy.

BRASS MATERIAL—MILL SHIPMENTS

In effect December 2, 1927
To customers who buy 5,000 lbs. or more in one order.

	Net base per lb. High Brass	Low Brass	Bronze
Sheet	$0.18¾	$0.20¼	$0.22¼
Wire	.19¼	.20¾	.22¾
Rod	.16½	.21	.23
Brazed tubing	.26¾	.....	.32
Open seam tubing	.26¾	.....	.32
Angles and channels	.29¾	.....	.35

For less than 5,000 lbs. add 1c. per lb. to above prices.

BRASS SEAMLESS TUBING

23⅝c. to 24⅝c. net base.

TOBIN BRONZE AND MUNTZ METAL

Tobin Bronze Rod	20¾c. net base
Muntz or Yellow Metal Sheathing (14"x48")	18¾c. net base
Muntz or Yellow Rectangular sheet other Sheathing	19¾c. net base
Muntz or Yellow Metal Rod	16¾c. net base

Above are for 100 lbs. or more in one order

NICKEL SILVER (NICKELENE)

Net Base Prices

Grade "A" Sheet Metal		Wire and Rod	
10% Quality	26½c.	10% Quality	29½c.
15% "	28 c.	15% "	33¼c.
18% "	29¼c.	18% "	36½c.

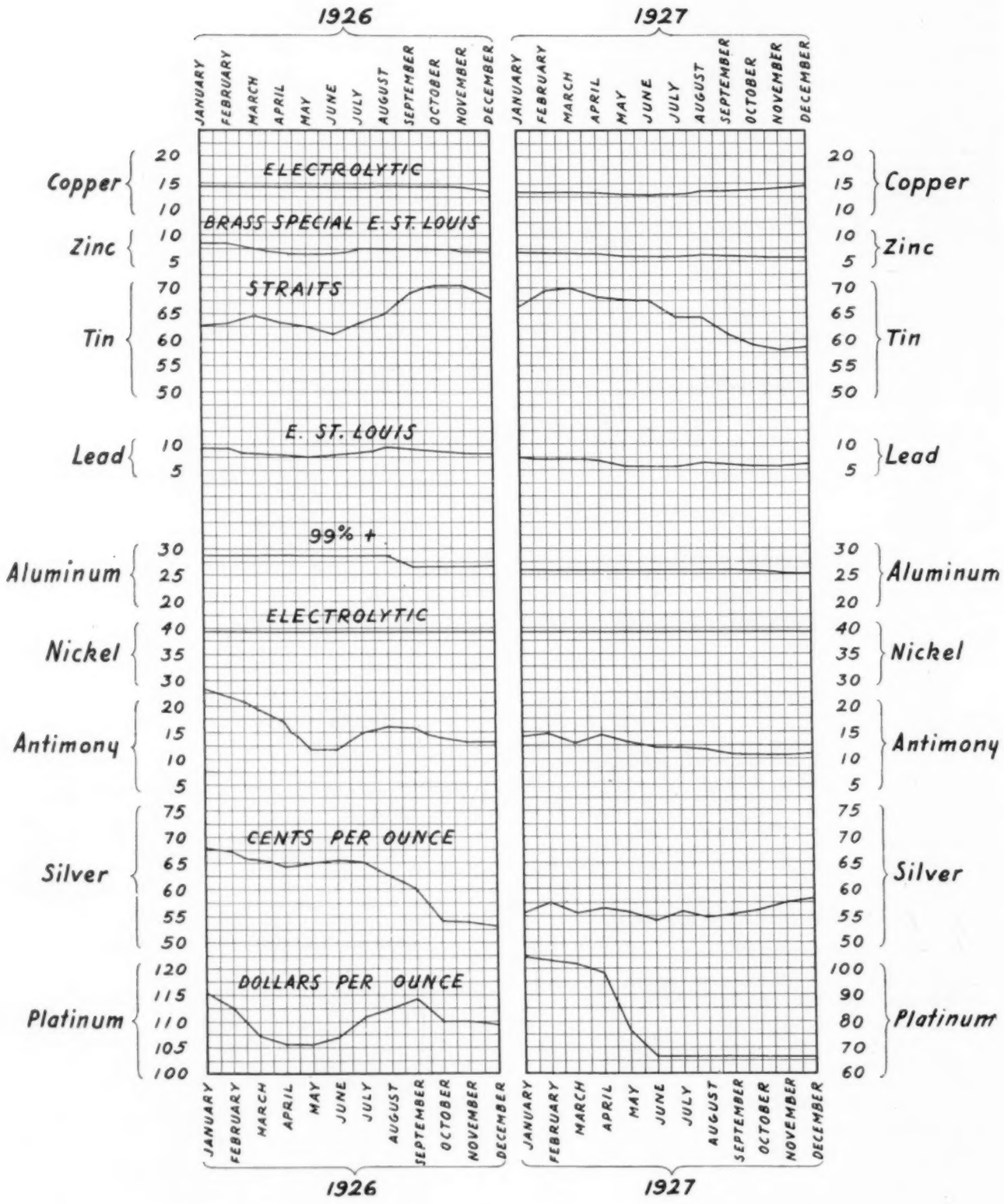
MONEL METAL SHEET AND ROD

Hot Rolled Rods (base) 35	Full Finished Sheets (base) 42
Cold Drawn Rods (base) 43	Cold Rolled Sheets (base) 50

BRITANNIA METAL SHEET

No. 1 Britannia—18" wide or less, No. 26 B. & S. Gauge or thicker, 500 lbs. or over, 8c. over N. Y. tin. price; 100 lbs. to 500 lbs., 10c. over; 50 to 100 lbs., 15c. over; 25 to 50 lbs., 20c. over; less than 25 lbs., 25c over. Prices f. o. b. mill.

Chart of Metal Prices for 1926-1927



SUPPLY PRICES ON PAGE 62

Pig Iron and Metal Products of the United States

Calendar Years 1918-1926. (1927 Estimated.)

(FROM THE UNITED STATES BUREAU OF MINES)

PRODUCTS METALLIC	1918 Quantity	1918 Value	1919 Quantity	1919 Value	1920 Quantity	1920 Value	Products
Pig iron (spot value), long tons	38,230,440	$1,180,759,565	30,130,231	$775,915,043	35,710,227	$1,140,904,096	Pig iron
Copper, sales value, pounds	1,908,533,595	471,408,000	1,286,419,329	239,274,000	1,209,061,040	222,467,000	Copper
Zinc, sales value, short tons	492,405	89,618,000	452,272	66,032,000	450,045	72,907,000	Zinc
Tin, short tons	69	118,500	56	73,400	22	22,000	Tin
Lead (ref.) sales value, short tons	539,905	76,667,000	424,433	44,990,000	476,849	76,296,000	Lead
Aluminum, pounds	*	41,159,000	*	38,558,000	*	41,375,000	Aluminum
Nickel, value at New York, short tons	441	401,000	511	434,485	365	293,250	Nickel
Quicksilver, value at S. Fran., flasks	32,883	3,863,752	21,415	1,933,560	13,392	1,066,807	Quicksilver
Antimonial lead, short tons (F. & D.)	18,570	2,826,350	13,874	1,513,968	12,535	1,963,255	Antim. Lead
Silver, commercial value, troy ounces	67,810,139	66,485,129	56,682,445	63,533,652	55,361,573	60,801,955	Silver
Gold, coining value, troy ounces	3,320,784	68,646,700	2,918,628	60,333,400	2,476,166	51,186,900	Gold
Platinum, New York City, troy oz.	59,753	6,417,980	45,109	5,614,335	41,544	4,697,722	Platinum
Total value of metallic products (approximate) (b)		$2,153,318,000		$1,359,744,000		$1,762,350,000	

PRODUCTS METALLIC	1921 Quantity	1921 Value	1922 Quantity	1922 Value	1923 Quantity	1923 Value	Products
Pig iron (spot value), long tons	16,038,619	$389,437,792	27,670,738	$608,144,858	38,361,379	$946,799,378	Pig iron
Copper, sales value, pounds	505,586,098	65,221,000	950,285,947	128,289,000	1,434,999,962	210,945,000	Copper
Zinc, sales value, short tons	198,232	19,823,000	353,274	40,273,000	508,335	69,134,000	Zinc
Tin, short tons	4	2,400	1	912	2	1,623	Tin
Lead (ref.) sales value, short tons	398,222	35,840,000	468,746	51,562,000	543,841	76,138,000	Lead
Aluminum, pounds	*	10,906,000	*	13,622,000	*	28,305,000	Aluminum
Nickel, value at New York, short tons	111	86,000	208	133,191	100	71,605	Nickel
Quicksilver, value at S. Fran., flasks	6,339	300,595	6,375	368,348	7,937	521,302	Quicksilver
Antimonial lead, short tons (F. & D.)	10,064	870,059	8,075	844,993	14,190	1,950,370	Antim. Lead
Silver, commercial value, troy ounces	53,052,441	53,052,441	56,240,048	56,240,048	73,335,170	60,134,839	Silver
Gold, coining value, troy ounces	2,422,006	50,067,300	2,363,075	48,849,100	2,502,632	51,734,000	Gold
Platinum and allied metals, value at New York City, troy ounces	56,370	4,238,989	57,718	5,932,726	49,797	5,762,305	Platinum
Total value of metallic products (approximate) (b)		$654,130,000		$987,180,000		$1,510,930,000	

PRODUCTS METALLIC	1924 Quantity	1924 Value	1925 Quantity	1925 Value	1926 Quantity	1926 Value	Products
Pig iron (spot value), long tons	31,064,129	$665,078,972	36,814,702	$739,316,333	38,181,053	$749,633,468	Pig iron
Copper, sales value, pounds	1,634,249,192	214,087,000	1,674,869,886	237,832,000	1,739,622,094	243,547,000	Copper
Zinc, sales value, short tons	515,831	67,058,000	555,631	84,456,000	611,991	91,799,000	Zinc
Tin, short tons	7	7,028	14	15,980	8	10,400	Tin
Lead (ref.) sales value, short tons	566,407	90,625,000	654,921	113,956,000	680,685	108,910,000	Lead
Aluminum, pounds	*	37,607,000	*	36,430,000	*	37,583,000	Aluminum
Nickel, value at New York, short tons	191	114,903	272	169,664	306	223,598	Nickel
Quicksilver, value at S. Fran., flasks	10,085	692,739	9,174	762,616	7,642	702,323	Quicksilver
Antimonial lead, short tons (F. & D.)	20,787	3,376,713	19,667	3,785,547	22,524	3,916,714	Antim. Lead
Silver, commercial value, troy ounces	65,407,186	43,822,814	66,155,424	45,911,864	62,718,746	39,136,497	Silver
Gold, coining value, troy ounces	2,528,900	52,277,000	2,411,987	49,860,200	2,335,042	48,269,600	Gold
Platinum and allied metals, value at New York City, troy ounces	66,007	7,611,319	49,643	5,661,809	84,981	9,210,669	Platinum
Total value of metallic products (approximate) (b)		$1,232,330,000		$1,380,280,000		(Not available)	

1927 ESTIMATED	Quantity	Value Total	Value Per Unit
Pig iron (spot value) long tons	36,400,000	$675,220,000	18.55 (a)
Copper, sales value, short tons (January-November inclusive)	1,347,583	353,713,586	13.124c. lb. (c)
Zinc, sales value, short tons	613,548	77,540,196	6.319c. lb. (d)
Tin (imports) long tons	72,490	103,236,664	64.371c. lb.
Lead sales values, short tons (January-November inclusive)	630,316	83,201,712	6.6c. lb. (d)
Aluminum, pounds	160,000,000	41,316,800	25.823c. lb.
Silver, troy ounces	58,645,622	33,060,883	56.374c. oz.
Gold, troy ounces	2,178,197	45,023,332	$20.67

(a) Composite, from The Iron Age.
(b) Includes some items of minor interest to metal trades not shown in table.
(*) Bureau not at liberty to publish figures.
(c) New York. (d) E. St. Louis.

SUPPLY PRICES ON PAGE 62

Supply Prices, January 9, 1928

ANODES

Copper:	Cast	21 c. per lb.
	Rolled	19⅞c. per lb.
	Electrolytic	18¼c. per lb.
Brass:	Cast	20 c. per lb.
	Rolled	19⅞c. per lb.
Zinc:	Cast	11 c. per lb.
Nickel:	90-92%	45c. per lb.
	95-97%	47c. per lb.
	99%	49c. per lb.

Silver: Rolled silver anodes .999 fine are quoted from 60¾c to 62¾c., Troy ounce, depending upon quantity purchased.

FELT POLISHING WHEELS WHITE SPANISH

Diameter	Thickness	Under 100 lbs.	100 to 200 lbs.	Over 200 lbs.
10-12-14 & 16"	1" to 3"	$3.00/lb.	$2.75/lb.	$2.65/lb.
6-8 & over 16	1 to 3	3.10	2.85	2.75
6 to 24	Under ½	4.25	4.00	3.90
6 to 24	½ to 1	4.00	3.75	3.65
6 to 24	Over 3	3.40	3.15	3.05
4 up to 6	¼ to 3	4.85	4.85	4.85
4 up to 6	Over 3	5.25	5.25	5.25
Under 4	¼ to 3	5.45	5.45	5.45
Under 4	Over 3	5.85	5.85	5.85

Grey Mexican Wheel deduct 10c per lb. from White Spanish prices.

COTTON BUFFS

Full Disc Open buffs, per 100 sections.

12" 20 ply 64/68	Unbleached	$30.10–31.70
14" 20 ply 64/68	Unbleached	40.10–40.80
12" 20 ply 80/92	Unbleached	31.92–32.40
14" 20 ply 80/92	Unbleached	42.20–43.70
12" 20 ply 84/92	Unbleached	36.30–37.15
14" 20 ply 84/92	Unbleached	48.60–50.40
12" 20 ply 80/84	Unbleached	36.30–39.55
14" 20 ply 80/84	Unbleached	48.60–53.60

Sewed Pieced Buffs, per lb., bleached 55–70c.

CHEMICALS

These are manufacturers' quantity prices and based on delivery from New York City.

Acetone	lb.	.11-.17
Acid—Boric (Boracic) Crystals	lb.	.12
Chromic, 125 lb. drums	lb.	.25
Hydrochloric (Muriatic) Tech., 20°, Carboys	lb.	.02
Hydrochloric, C. P., 20 deg., carboys	lb.	.06
Hydrofluoric, 30%, bbls	lb.	.08
Nitric, 36 deg., carboys	lb.	.06
Nitric, 42 deg., carboys	lb.	.07
Sulphuric, 66 deg., carboys	lb.	.02
Alcohol—Butyl	lb.	.19-.23½
Denatured, bbls.	gal.	.59
Alum—Lump, Barrels	lb.	.03¼
Powdered, Barrels	lb.	.042
Aluminum sulphate, commercial tech	lb.	.02⅜
Aluminum chloride solution in carboys	lb.	.06½
Ammonium—Sulphate, tech., bbls	lb.	.03¾
Sulphocyanide	lb.	.65
Arsenic, white, kegs	lb.	.05
Asphaltum	lb.	.35
Benzol, pure	gal.	.60
Borax Crystals (Sodium Biborate), bbls	lb.	.04½
Calcium Carbonate (Precipitated Chalk)	lb.	.04
Carbon Bisulphide, Drums	lb.	.06
Chrome Green, bbls.	lb.	.28
Chromic Sulphate	lb.	.37
Copper—Acetate (Verdigris)	lb.	.37
Carbonate, bbls.	lb.	.16–.17
Cyanide (100 lb. kegs)	lb.	.50
Sulphate, bbls.	lb.	.05¾
Cream of Tartar Crystals (Potassium Bitartrate)	lb.	.27
Crocus	lb.	.15
Dextrin	lb.	.05–.08
Emery Flour	lb.	.06
Flint, powdered	ton	$30.00
Fluor-spar (Calcic fluoride)	ton	$75.00
Fusel Oil	gal.	$4.45
Gold Chloride	oz.	$14.00
Gum—Sandarac	lb.	.26
Shellac	lb.	.59–.61
Iron Sulphate (Copperas), bbl.	lb.	.01½
Lead Acetate (Sugar of Lead)	lb.	.13¾
Yellow Oxide (Litharge)	lb.	.12½
Mercury Bichloride (Corrosive Sublimate)	lb.	$1.58
Nickel—Carbonate, dry, bbls.	lb.	.29
Chloride, bbls.	lb.	.17–.18
Salts, single, 300 lb. bbls.	lb.	.10½
Salts, double, 425 lb. bbls.	lb.	.10
Paraffin	lb.	.05–.06
Phosphorus—Duty free, according to quantity	lb.	.35–.40
Potash, Caustic Electrolytic 88-92% broken, drums	lb.	.09¾
Potassium Bichromate, casks (crystals)	lb.	.08½
Carbonate, 96-98%	lb.	.07–.07½
Cyanide, 165 lb. cases, 94-96%	lb.	.57½
Pumice, ground, bbls.	lb.	.02½
Quartz, powdered	ton	$30.00
Rosin, bbls.	lb.	.04½
Rouge, nickel, 100 lb. lots	lb.	.25
Silver and Gold	lb.	.65
Sal Ammoniac (Ammonium Chloride) in casks	lb.	.05½
Silver Chloride, dry	oz.	.86
Cyanide (fluctuating)	oz.	.60
Nitrate, 100 ounce lots	oz.	.41½
Soda Ash, 58%, bbls.	lb.	.02½
Sodium—Cyanide, 96 to 98%, 100 lbs.	lb.	.19
Hyposulphite, kegs	lb.	.04
Nitrate, tech., bbls.	lb.	.04¾
Phosphate, tech., bbls.	lb.	.03¾
Silicate (Water Glass), bbls.	lb.	.02
Sulpho Cyanide	lb.	.45
Sulphur (Brimstone), bbls.	lb.	.02
Tin Chloride, 100 lb. kegs	lb.	.42½
Tripoli, Powdered	lb.	.03
Wax—Bees, white, ref. bleached	lb.	.60
Yellow, No. 1	lb.	.45
Whiting, Bolted	lb.	.02½–.06
Zinc Carbonate, bbls.	lb.	.11–.12
Chloride, casks	lb.	.06¾
Cyanide (100 lb. kegs)	lb.	.41
Sulphate, bbls.	lb.	.03¾